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## WOMEN'S PROFESSIONS, OCCUPATIONS AND BUSINESS COUNSELLOR

# MANUAL TRAINING AS A FACTOR IN EDUCATION

*By ARTHUR LYMAN WILLISTON*
*Director of Department of Science and Technology, Pratt Institute, Brooklyn, New York*

We are often asked why it is that we place so much emphasis on Manual Training here at Pratt Institute and devote so much time and thought to its development. It is not an easy question to answer in a word, because there is so much more in the subject than appears on the surface. Let me illustrate: Take, for instance, a child at work on any typical exercise, such as constructing a printing-frame of the kind photographers use in making prints from their negatives. He is eager to begin because he knows something of the beautiful results of photography; and he is anxious to have a frame himself with which he may make some experiments. We can count, therefore, on his putting his best energies into the work to make it as good as possible; and we have his active coöperation until the frame is finished.

He is ready to begin, and we will notice the mental operations which he goes through if the exercise has been wisely planned. What is the first step? He must read the drawing carefully and interpret it. He must use his imagination and picture the finished piece. Then he must analyze it and plan the method that he will use. He must lay out each piece accurately so that the whole will fit together. He must use method to get the best results. As the work progresses, each step involves some principle which he must remember and apply, and at each step he must exercise reason and good judgment if he is to accomplish his purpose and get a perfect frame. As the work approaches completion, more nicety is required, calling for closer observation, greater power of concentration, and greater need of accuracy.

A spirit of self-reliance and careful earnestness has been necessary from the start if the pupil is to realize his desire in the finished result, and throughout it all the motive force has come from within. Prompted by his own desires, he exercises his powers to the utmost, in a way to make the most lasting impression.

The frame is finished, and is a just source of pride to the pupil, and to his friends and parents as well, but its influence on his life may not be ended. During its construction an interest in its use was

created, and that interest may and should lead on to further action and further development.

Thus, briefly outlined, are the powers brought into operation by every exercise in Manual Training, each succeeding piece taxing the resources a trifle more than the last, or calling for the exercise of some new faculty. And as we note the growth of intellectual power, we begin to understand the statement that Manual Training makes its appeal to the reason, the will, and the emotions, as well as to the physical side of the child nature. He is learning through his own experience just as the race first acquired its knowledge — and we all know that experience is the best of all teachers.

When we realize the meaning of Manual Training, we see how misleading is the name, for its object evidently is not alone the training of the hand,— however desirable this may be — but rather is cultivating and developing all the mental powers through the hand. It is mind and character training *through* hand-work, and not as the name might indicate, merely hand training. Of course we appreciate that the hand training has a very distinct utilitarian value, and that the training of hand and eye and the acquiring of skill and dexterity may have a very positive value in after life; and yet the mental development that is acquired through this work is of far greater importance. At first it was difficult to realize how this could be, and how a boy could, by performing some task at the bench or at the forge, obtain a certain mental development that might be impossible through the study, for instance, of Latin or mathematics. Indeed, it was some time after Manual Training was first introduced that those most interested in the subject fully realized this and appreciated its true educational significance. It was first introduced into schools in this country because of its technical and practical value, but soon its deeper value was discovered.

The reason for this is now very apparent, for we have come to realize that education consists not of the acquiring of knowledge which may be administered to the child's brain, much as we might administer generous slices of watermelon to his stomach. Modern psychology and physiology teach us that education is the development of faculties — the unfolding of the child's nature from within, much as a plant grows and unfolds; and for the motive force we must rely largely on the natural instincts of the child toward activity and discovery — instincts which nature put there for the purpose. As soon as we accept this theory of education, we begin to understand how it is that through action and thought — work in which there is absorbing interest — the child may gain more of intellectual growth than in any other way. In fact, we profoundly believe that lessons learned

through work which is closely related to natural interests, are by far the most impressive and intelligible of all lessons, and produce the most lasting effect on the learner.

I cannot emphasize too strongly the importance of the idea which is fundamental to Manual Training, that the development should be from within, outward, and not the other way. Children, stimulated by their own desires and interests, should be led to discover, to invent, to produce; for it is only by this means that we can properly fit them to take their part in life. The need of the day is for men of action; men and women who can do, as well as think; individuals with power, as well as with knowledge.

It is because of this peculiar value of Manual Training to train the will, through the continual overcoming of difficulties to cultivate power, to stimulate individual action, and to develop executive ability to the limit of the pupil's mental capacity, that I would urge every thoughtful parent to consider it. And I would urge every mother and father who is anxious for these advantages for their children, to provide some form of Manual Training for them during the formative years.

But there are other reasons, which I cannot pass without mention, why Manual Training should enter all our schools, both public and private. Professor James tells us that all education is but the "organization of acquired habits of conduct and tendencies to behavior." If this be so, how can we overestimate the value of forming in early life, through Manual Training, habits of care and accuracy, neatness and order, system in thought and action, the habit of overcoming difficulties by perseverance, and the habit of putting thought into action.

Manual Training leads to an appreciation of the beautiful and of the esthetic side of life. This is very different from the idea that many have who have not given the matter any thought. They say: "We don't want our children to waste their time on work that is meant only for mechanics"; but they do not understand. Imagine a child given, as an exercise in turning, a vase form. He is given photographs of many of the most famous and beautiful vases to study. He becomes interested in them, for he must choose which of the various forms he will copy. As his work is gradually rounding into shape, he is getting an insight into and an impression of the beauty of form and outline that will never desert him; for we only thoroughly understand and appreciate that which we can produce ourselves. So also can feeling for perfect form, harmony of color, and other elements of design be made the basis of many exercises.

## CHANGED CONDITIONS AND NEW SOCIAL NEEDS

Faster than we can possibly realize, have the conditions of life in this country changed, and they will continue to change. Mighty forces are at work, and if we accommodate ourselves to the new conditions, we shall find these changes vastly to our advantage. If we try to meet the new conditions by methods adapted to other times, however, we shall find it quite different. The changes are of two kinds: social and industrial. Rural life has given way to life in large communities, and modern science has been harnessed to the problem of production and transportation, without which the recent marvelous progress in material wealth would have been impossible.

The world has discovered the gain that may come through combined effort and united action, where large numbers of human beings with common interests are brought together, and it will never go back to the rural conditions of isolated individual effort of the generations gone by. The world has discovered the value of steam to industry, and will never go back to the old form of manual labor as a source of power. Steam, electricity, and the other forces of nature are of too much service to man to render that possible. On the other hand, they are each day making new inroads into our industries and finding a wider and wider application.

The conditions which our children will have to meet in getting their start in life will therefore be very different from those which we ourselves had to face but a few years ago. It is to meet these new conditions, both social and industrial, that Manual Training has sprung into being, and it is to this demand that it owes its very rapid growth in our school systems.

The question most naturally arises in the mind of the reader: "If Manual Training is so essential to the development of mind and character, how does it happen that we have been able to get along without it in the past? We have produced great men and fine minds, long before Manual Training was a subject taught in any school." It looks as though there were some mistake, but there is none. The old conditions of rural or semi-rural life, and the men who grew up under them, prove the strongest argument for Manual Training.

Take the small boy or girl growing on the farm or in the country village, surrounded by those influences which were typical all through the early history of this country, almost from the date of its settlement down to within a very few years. The whole of the child's life, from the time that he first became old enough to be of service to his parents, or to take an interest in things, was a care-

fully arranged course in Manual Training. The district school formed but a part — and usually a very small part — of the whole training which the child received. The plain common sense of the people put our latter-day theories into practice,— that education through productive and useful work of the hands is essential to right intellectual and moral training; and every mother and every father saw to it that the boy or girl had some useful occupation, on the farm, at the work-bench, or in the kitchen, or dairy, to supplement the school training. Neither was complete without the other; and the common school which trained the memory and the purely intellectual faculties only, was intended to be supplemented by the home training to cultivate the more practical side of the children's natures.

But, as we have seen, the times have changed. Crowded together as we are in cities, with little space about us, parents have neither the time nor the means to give their children Manual Training at home. To-day, children cannot, as a rule, help their parents in their work, as of old, because the work is done either at the office or factory or else it is relegated to employees or servants.

On the other hand, the school which used to occupy but a few hours per day for a few months in the year, has gradually encroached on the children's time, occupying as it does the greater part of the day for ten months in the year, until there would not now be time enough left for the home training, if opportunity for it could otherwise be offered.

## INFLUENCE OF MANUAL TRAINING ON THE LIVES OF GREAT MEN

How many of the men who have risen to prominence in every walk of life owe much of their success to the mental development and character-building, which came to them in their youth through the manual work which they did for themselves or their parents! Doubtless many examples occur to all of us, and it is hardly necessary to add to the list. It is easy to choose names from almost any occupation, and it is interesting to note that practical and mechanical training in early life seems to have been of as much value to men of letters as to men of affairs. Thus, Benjamin Franklin had but two years of school training, and the rest of his mighty mental equipment was mainly the outgrowth of the shop of a candle maker, and the printing-room where he did the manual work himself. Horace Greeley had only what a country school could give him, but the country life where he spent his early years did much to

supply the deficiency. Lord Byron had nothing beyond the Grammar school, but was passionately fond of out-door sports — riding, games, and athletics. Alexander Dumas was an apprentice, getting all his early education at home. George A. Gordon and Robert Collyer, two of the foremost preachers in the pulpits of Boston and New York to-day, are men who were blacksmiths by trade. The two Presidents foremost in our country's history had little schooling, and much of out-door work in their early life. Washington was largely self-educated, fond of sports and exercise, and the plantation life of Virginia in his time gave him excellent opportunity for self-development on practical lines. Lincoln had but a single year of school, and much hard work throughout his boyhood. Who can doubt that this early training on a Western farm did much toward developing the qualities of mind and heart which won the Nation's love and admiration?

The men of science, too, who have been of most lasting service to the world and who have made the most important discoveries, have been men who had manual work or training through early life. Galileo made his own telescopes; and Newton was a skilled instrument maker, even grinding the lenses himself for his famous telescope. Edison had but two months of school training. The great inventions, with very few exceptions indeed, have been the work of men who toiled with their hands. The steam-engine, the locomotive, and the steamboat came into existence through the native genius of the instrument maker, Watt; the brakeman, Stephenson; the jeweler's apprentice, Fulton. Printing, the telephone, the phonograph, photography, in black and in colors, were all invented by practical men, and were not the result of abstract thought.

The reader may think that these names have been carefully selected and that other names could be given which would show the reverse. To some slight extent this may be true, of course, but large lists of several thousand names of prominent men have been taken when the selections have been made for other purposes; as, for instance, the list of names admitted to an encyclopedia of biography, and it has been found that a very considerable majority of those about whose early history anything could be learned had had more than the average physical training of one kind or another.

Are not these facts significant? If we wish to give the best advantages to our children, must we not admit that it is impossible to fully develop their minds for all the varied necessities of life, and to give them the broadest culture, unless the whole body share in the development? And under present conditions, are we not forced to agree that it is the business of the school to provide for the culture of the whole child,— not merely of his mental faculties?

## THE HEALTH OF THE CHILDREN

Before leaving this subject, let us inquire into the conditions as they exist to-day in most of our large cities, and see if the experience from courses consisting entirely of book training are satisfactory, and are of the benefit to the children that they ought to be. Let us consider the matter of health. Do the children come from the schools strong and robust, full of health and vigor, as they entered them? If they do not, surely reform is needed, for the most precious thing in life is life, and that which shortens life and impairs health is dangerous.

I wonder if it is generally known that a year ago, in five cities alone in this country, there were over sixteen thousand children, between the ages of eight and fourteen, taken out of the public schools because they had broken down — their minds incapable of going further, and their nervous systems shattered. These are simply the children that we know about; but consider the number whose health is permanently injured but who may still be able to keep at school. Would it be unsafe to say that the number of those would be two or three or even five times as great? I think not. This would mean fifty to one hundred thousand of our younger children each year whose lives are injured and whose health is impaired. These facts are most appalling. Do they not answer the question: Is reform needed? Shall we go on cramming the minds of the helpless children with things that they do not understand, at the expense of their physical nature?

But it is not necessary to go even to statistics for our answer. The common experience of every child tells the story. He goes to school active and alert, full of energy and play. Five hours each day he sits bolt upright in an uncomfortable chair, with books before him in which he has no interest and which have no meaning to him. Fortunately Nature asserts herself, for while the body is held prisoner, the active brain wanders from the unknown lessons to the realities of tops and marbles, base-ball and kites, and the child is perhaps saved from becoming a fool. But every time he seeks to give outward expression to the pent-up energy within him, he is restrained. "Don't" is the atmosphere in which he lives. Listen to the joyful outburst and enthusiasm and interest in all things that pertain to natural and unrestrained child life, and judge whether the influence of the school is to repress or to develop the child's power. The habits formed through all the school years, of remaining inactive when natural impulse says act, will follow the child through life.

It is, therefore, to give wholesome physical activity to the school life and to improve the health of the children that Manual Training demands admission to the schools. It is to give reality and meaning to the lessons that are dry and dull without concrete illustrations; it is to give natural outlet to the pent-up energy and activity, and to direct them to useful purpose for future needs, instead of repressing them; it is to preserve and cultivate the interest and enthusiasm and power of youth for the necessary activities of later years; it is for one and all of these reasons that Manual Training demands admission to the whole school system, from the kindergarten to the college, not merely once or twice a week, but five times a week.

## THE IDEAL SCHOOL

The ideal of modern education is not reached through Manual Training alone, any more than it is through language, science, mathematics, or art. But manual instruction should take its place in the lower and secondary schools alongside of the other recognized means of culture. It should be closely correlated to all the other subjects and furnish, as far as possible, the concrete illustrations of the principles brought out in them. On the other hand, as far as possible, the principle underlying Manual Training should be applied to all the other subjects. They should be made constructive, and the pupil should be led through natural interests and desire to discover laws himself, to apply principles and classify facts. Creative power, as well as perception and receptivity, should be cultivated in all subjects.

## SUGGESTIONS TO PARENTS

Many of the readers who have followed my thought through the foregoing, and who have agreed in the main with the arguments presented, will, nevertheless, feel at a loss to know what can be done for the children in whom they are interested, and how they can secure for them the benefits that they believe are most desirable. To these I make the following suggestions: —

Of course, if it is possible, have the children attend a modern school, where they will have the advantages of a symmetrical training such as I have tried to describe. But if this is impossible — and in most cases, unfortunately, it still is — the only hope is through the present schools and through such outside influences as may be brought to bear on the children's lives, to make good the deficiences of the school curriculum.

*First*—I would urge parents to become interested in the schools; to get their friends and neighbors to take an active interest, also; and to use their influence, wherever possible, to get the school boards and committees to introduce Manual Training upon a rational basis.

*Second*—I would urge them to come into touch with the teachers, so that they may better understand what their children are doing, and to persuade teachers not to push the children forward faster, but rather to hold them back; not to have them begin more subjects, but to be satisfied with thoroughness in few.

*Third*—I would urge them to take a greater interest in their children's work, and to encourage reading and conversation related to the work (but not helping them directly in the day's lesson), which will stimulate a deeper interest.

*Fourth*—With the school sessions lasting from nine until twelve, and from one until three, there is so little time left for play that every hour is precious; and play is one of Nature's methods of caring for both physical and mental needs. I would therefore urge parents to encourage all legitimate forms of play,—especially those which call for activity, skill, and judgment. With older children, athletics, if not carried to excess, may do valuable service.

*Fifth*—Encourage activity in every natural direction during vacations, especially during the long summer vacation; and, if possible, give the children an opportunity to get away to the country or seashore, where the greatest variety of outdoor activity is possible. For older children, some form of work during the long vacation should be found, if continual outdoor activity and sport is impossible. But in all cases where sports and out-door pursuits are encouraged, children should be urged to apply their minds to them, as well as their bodies. If they are interested, for instance, in boating, let them study the different forms of boats, the different kinds of rigging, the conditions under which each is best, and encourage them to try to understand the reasons for these things in which they are interested.

*Sixth*—I would urge the parents to encourage children in constructive work. A place for a few simple tools can easily be found where the child can have a course of Manual Training of his own, where he can plan in detail what he is going to make and carry it to completion.

In one or all of these ways, I believe, it is possible for every parent, if he or she will give the time and thought to the matter, to be of very material service, not only in helping the schools to do better for the children, but in helping to supplement the training that the schools give, through the outside interests and activities of the children.

# THE KINDERGARTEN GIFTS IN THE HOME

## FIRST GIFT

CHILDREN living in small or remote communities are not necessarily cut off from all of the advantages of the kindergarten system. With some general knowledge of the principles of this system as founded by Froebel, and with a few simple materials, the mother can conduct a home-kindergarten, which, while not, of course, equal to a kindergarten conducted by a trained teacher, will prove of

much pleasure and benefit to the children. The materials needed can be easily manufactured, or they can be obtained from a kindergarten supply store in any large city. Some of these are called "gifts" in the Froebel system, and they are graded to meet the needs of the growing child, from the elementary colored balls of the first gift, to the seeds and shells of the thirteenth gift.

These "gifts" are more than playthings. The genius of Froebel perceived a correspondence between them and the various stages of the child's intellectual growth. He therefore organized play as a means of education. He saw that the baby noticed colors, and liked the feeling of a round surface, therefore he made his first gift the colored ball and string. He saw that children liked to make mud-pies, therefore he gave them clay modeling. He saw that they liked

to take their toys apart, therefore he gave them the divided cube He chose the ball as his first gift because it is the shape most easily grasped by both the hand and the mind; because in its unity of form it is symbolic of the child's mental state; and, in its tendency to motion, of the child's activity.

The first gift, then, consists of six worsted balls, each ball having one of the colors of the rainbow — green, blue, yellow, orange, red, and violet; to each ball is attached a string of the same color. With these balls and strings, the child is to gain its first impressions of unity, color, form, mobility, direction, and motion.

Lessons in color can be learned through a number of pretty games. The children can sit down in a circle on the floor of the nursery, or kindergarten, each with a ball, and roll the balls to each other as the mother, or teacher, calls out "Forward red ball"; "Back red ball"; or "Forward orange ball"; or she may say "Who has a ball like a cherry?" or "Who has a ball like an orange?" In this way the child not only learns to distinguish colors, but to associate them with natural objects. Games should be accompanied by songs. The children can stand in a row and swing their balls by the strings while they sing together: —

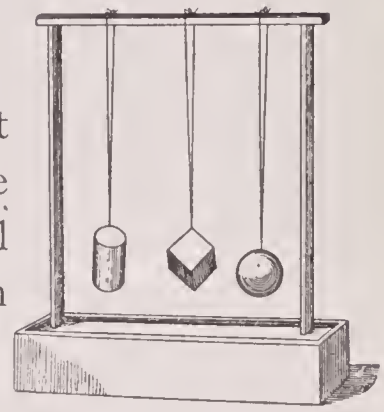
To and fro, in and out  
Swing our pretty balls about;  
Red and yellow, green and blue,  
Every lovely rainbow hue.

The child learns much from the motion of the balls; games should be played in which the balls are thrown from one to another; in which they are tossed in the air; in which they are rolled in opposite directions. Four children may make the corners of a square, or three the points of a triangle, and roll the balls to each other. Skill of hand and quickness of eye are thus cultivated, the muscles are trained, and the limbs brought into play. The child begins thus early to prepare for the games of tennis, of golf, of base-ball, of polo, for all those games in which the ball plays the principal part. He learns the general properties of form, size, weight, color, density, and volume. He is prepared to handle more complex forms, and to engage in less simple games.

## SECOND GIFT

Froebel's second gift consists of a wooden sphere, cube, and cylinder, two inches in diameter: standards and rods from which to swing the three pieces are used with this gift.

Its symbolism is of variety and of contrasts. The first gift taught unity of form and variety of color. The second teaches variety of form, and stimulates the powers of observation. The sphere and the cube are sharply contrasted forms, and the cylinder forms a connecting link between the two.



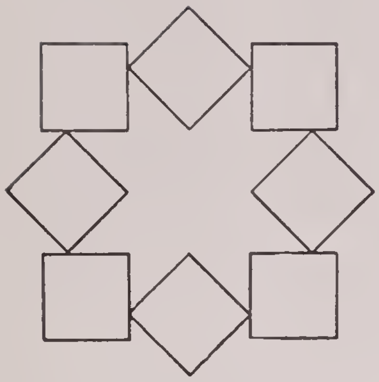
The child first of all contrasts the sphere with his first plaything the ball. He finds that the ball is soft, the sphere hard; the ball quiet, the wooden sphere noisy; yet they roll equally well; he finds that the cylinder also rolls, though it is different in shape from the ball. When he comes to contrast the sphere with the cube he finds a variety of differences. The cube will not run away from him, as the ball does when he lets go of it but stands firmly on one of its six surfaces. The ball is the symbol of motion, the cube of rest. The child can gradually be brought to understand why this is so — that the ball rolls because it stands only on a point of its surface, while the cube stands on the whole of its surface.

Many pretty experiments aid the child in understanding the qualities of these forms. The sphere can be placed on a plate and made to go around and around the rim by simply inclining the plate. The cube can be spun around on any one of its axes, and thus can be shown in many varying aspects. This variety of aspect can be increased by painting the faces of the cube each a different color.

The child should be taught to connect the shapes of cube, cylinder, and sphere, with other objects. He can play that the cylinder is a log which he is rolling home to chop up for firewood; or a barrel of flour that is being carried to the pantry. He can be shown a lump of sugar in the form of a cube; and a stick of candy in the form of a cylinder. Then he can be taught to build, placing his cylinder upon the cube, making thereby a pillar and its base; upon the top of the pillar he can learn to place the sphere and thus to add the touch of ornament. He can also be taught to count with these objects, saying "the sphere one, the cube two, the cylinder three." The cube is provided with eyelets through which to pass strings. On these strings it is revolved, teaching the child many phases of motion, swift or slow, or motion increasing from slow to swift. His faculty of discrimination is thus awakened and cultivated.

These three simple forms — the cube, the cylinder, and the sphere — wrought in marble, are part of the monument of Froebel, who first adapted them to the child's mental needs.

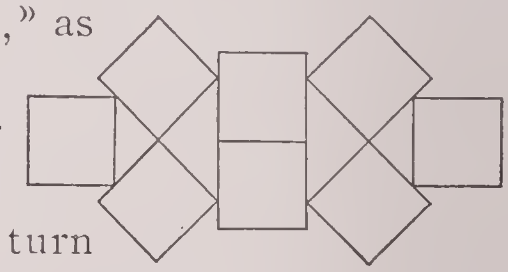
## THIRD GIFT



Froebel perceived that an early instinct of the child led him to take his toys apart, and to try to put them together again. Every child is an investigator and builder. The so-called destructiveness of children, for which they are often punished, is in reality not a malicious instinct, but a natural desire to explain for themselves the causes of things. They want "to see the wheels go 'round"; to understand what makes dollie's eyes shut; to know what is inside the drum; or in the little music box.

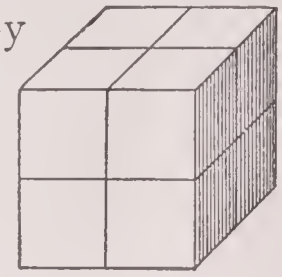
Realizing the importance of this instinct in aiding the child's development, Froebel chose as his third gift a wooden cube, subdivided by three cuttings into eight equal cubes, each representing the large cube, but on a smaller scale. The child is now in possession of a divided unit, which he may take apart and build up again. He is thus introduced to the idea of relativity: the relation of the parts to the whole, and of the whole to its parts. He sees that the parts are similar in shape to the whole, but dissimilar in size. His powers of analysis and synthesis are thus awakened and exercised. The uses to which the child can put these eight little blocks, and their influences upon his mental development, are manifold.

He should first be taught the mathematical significance of the divided cube by separating it into two equal parts, then into four, then into eight; the halves can be subdivided, the child learning to say "a half," "two quarters," "four quarters," as the case may be. He can pile the blocks one upon another, counting one, two, three, etc., or he can make two columns of four blocks each, or four columns of two blocks each; or he can turn the cube into an oblong, formed by two rows placed together. Numerous mathematical combinations can be thus made, the child receiving by these pleasant means his first lessons in the science of numbers.



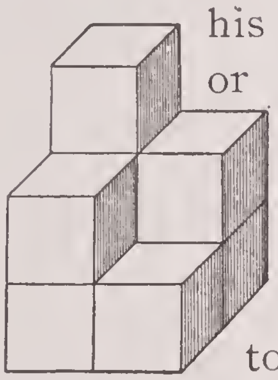
When the child has learned to count up to eight with his blocks, to add and subtract with them, he may then be taught to make what are termed in kindergarten phraseology "Forms of Life" and "Forms of Beauty." Forms of life represent things which the child sees in his every-day world, as a house, a clock, an arm-chair, etc. With the blocks he tries to reproduce these objects, and thus he becomes a workman in embryo; he is made familiar with common things; through his imagination he is for the time a carpenter, a builder, an

architect, a cabinet-maker. Chairs are easily made with the blocks of the divided cube; or a castle with towers, or a high cross, or a sentry box, or a station house, a bridge, a church, a clock, or a windmill. The child can construct an entire village of forms, by means of this symbolic building.



While he is engaged upon some work, the building of an engine for instance, questions should be asked him: what the engine does? where the engine goes? etc. He should be told all that he can understand about the uses of the engine. If he is building a bridge, he should be asked what bridges are for; if a window, what windows are for. He can thus be taught to reason, to use his powers of observation, to think for himself.

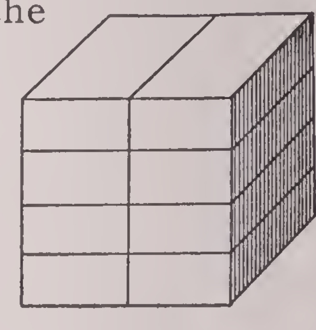
When he has exhausted his powers of ingenuity in building, he may then be shown how to make forms of beauty and symmetry. Forms of beauty are forms of the imagination which please by their symmetry — by the harmony of the parts. They appeal to the esthetic sense, to the innate love of beauty. They are made by placing the eight cubes in various relative positions so as to form stars, squares, octagons, crosses, and a variety of geometrical patterns. In making these forms of life, of beauty, and of knowlege, no order of procedure can be absolutely binding. The mathematical use of the blocks may appeal first to some children; the practical use to others. A child may prefer making forms of beauty to making arm-chairs with his eight cubes. He should be allowed to follow his fancy, or the purpose of the gift will be defeated. The teacher or mother may, however, suggest building enterprises. She may say she is in need of a house, or of a well in the garden, or of a windmill to grind her corn; and thus awaken the imagination of the child and his desire to accomplish a given task.



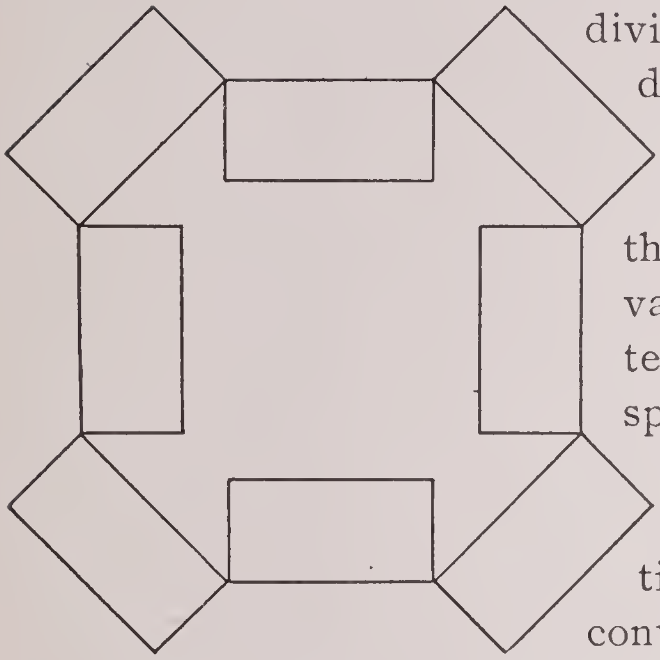
If several children are playing, each child should play only with his own eight blocks, and should not be allowed to take those of the other children. He thus learns to do much with limited material, to use the gift as it was intended to be used. When the play is over each set of eight cubes should be packed neatly in its own box, as a hint that "order is heaven's first law."

## FOURTH GIFT

"A NEW gift is demanded — a gift wherein the length, breadth, and thickness of a solid body shall be distinguished from each other by difference of size. Such a gift will open the child's eyes to the three dimensions of space, and will serve also as a means of recognizing and interpreting the manifold forms and structures with which he is constantly brought in contact."

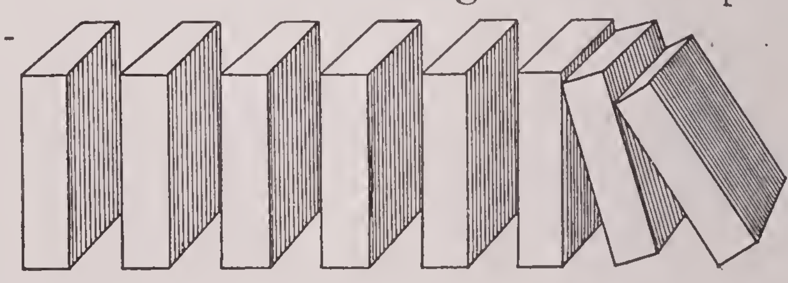


Froebel writes thus of his fourth gift, which consists of a cube divided into eight blocks, each two inches long, one inch broad, and half an inch thick. The lines of division are three in a horizontal and one in a vertical direction, making eight bricks. The fourth gift differs from the third in the shape of its parts. In the cube, similarity was everywhere; in the brick, the child is introduced to a form distinguished for its variety; there are "greater height and greater extension, resulting in a greater possible inclosure of space." The gift shows the progress of the child in the greater difficulties of manipulation which it presents, and in the many positions and combinations which the bricks can be made to assume. It conveys to the child a clearer idea of dimension. The dimensions of the brick being unequal they are more deeply impressed upon the child's mind. Of the brick form Dr. Seguin says: —



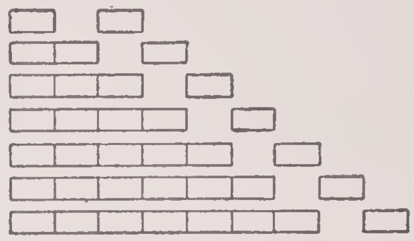
"What a spring of effective movements, of perceptions, and of ideas, in the exercises with this form where analogy and difference, incessantly noted by the touch and view, challenge the mind to comparison and judgment."

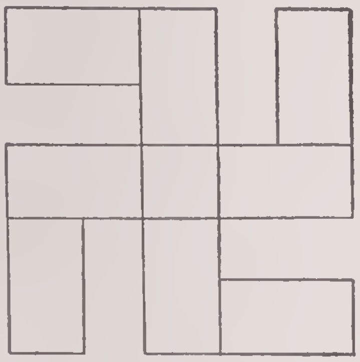
Perhaps the simplest method of showing the child the difference between the brick and the cube is to stand the eight bricks upon end and in a row; then by touching the first or last brick to throw the whole row down. By this illustration the child understands that he is playing with a form which requires more careful handling than the cube, and which admits of greater variety of combinations.



As with the third gift, the fourth can be used for forms of knowledge, of life, and of beauty. By making combinations of two, of four, of six, and of eight, bricks, the child learns the first principles of multiplication. By adding two bricks to four, or three to two

he learns simple addition. On the other hand he can learn to subtract by placing the eight bricks end to end in a line, and removing one at a time or two at a time, then counting those which are left; or saying, "Eight less one is seven," "Eight less two is six," etc. The mother or teacher can do the counting, until the child learns by imitation and by reasoning to count for himself. A simple rhyme is sometimes an aid in counting, as,—





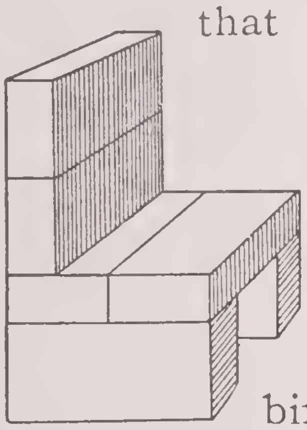
> Eight little bricks I see;
> Take five away and then there'll be three.

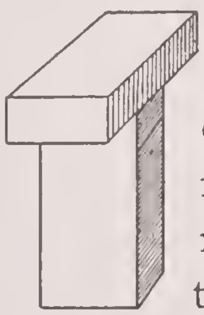
or,—

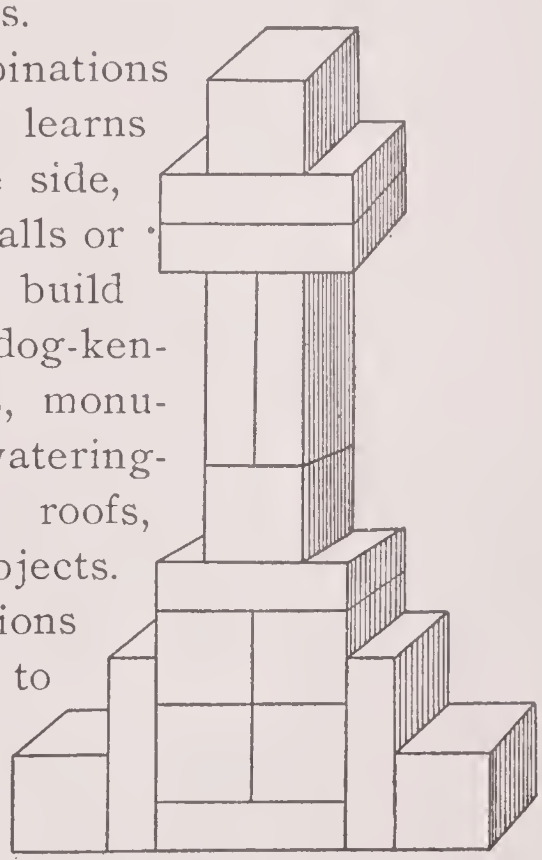
> Eight little bricks like soldiers tall;
> Count them one and count them all.

The forms of beauty which can be made with the eight bricks are elaborate and numerous. The child should be encouraged to invent a new one each day; or, if there are several children, they can compete with one another in the forming of original designs.

The forms of life which can be symbolized by combinations of the eight bricks are innumerable. The child soon learns that he can place his bricks on end, or on the side, or can use them for roofs or walls or supports. From them he can build chairs, tables, summer-houses, dog-kennels, sheds, arbors, guide-posts, monuments, staircases, bedsteads, watering-troughs, houses with slanting roofs, bird-perches, and a hundred and one other objects.





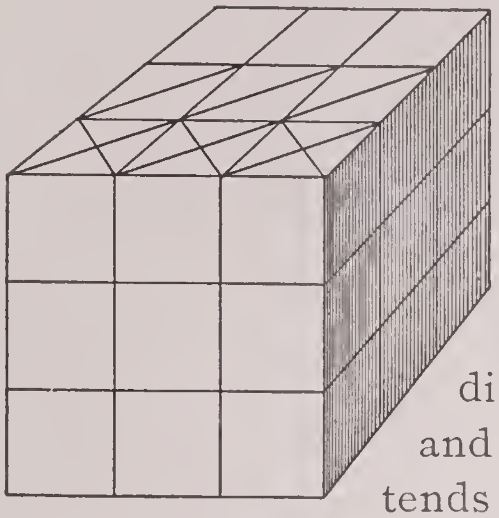


As the little architect grows more skilful, and his visions of building become more complex he should be allowed to use the cubes of the third gift in combination with the bricks of the fourth. He can now attempt villas and colonnades, two-story houses, tunnels, and towers. With the combination of bricks and cubes, elaborate forms of beauty can also be made, the child learning the value of contrast from the juxtaposition of the brick and the cube.

## FIFTH GIFT

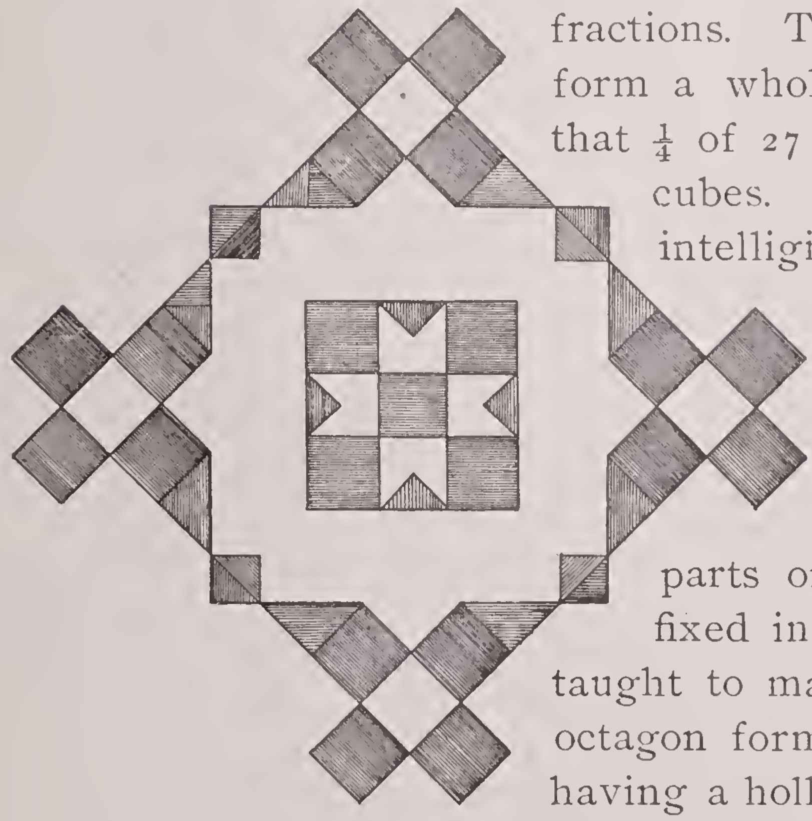
In Froebel's fifth gift, which, as a rule, is of use to a child only after he has passed his fifth year, more complex methods of education are taken up. This gift consists of a three-inch cube, which

being divided equally twice in each dimension produces twenty-seven equal cubes, each cube being of the same size as those of the third

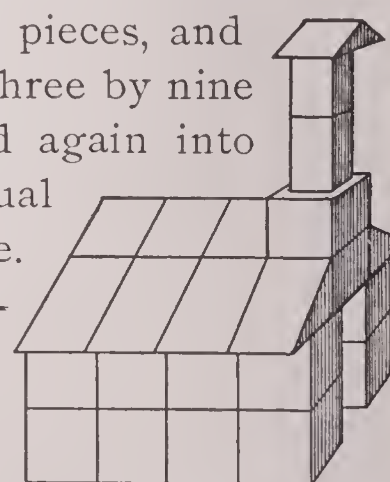


gift. Twenty-one of these cubes are solid; three are divided diagonally into halves, and three twice diagonally into quarters, making thirty-nine pieces. The novelty of this gift consists therefore not only in the greater number of pieces but in new forms, which introduce the oblique line and the triangle. The element of form is thus extended; while the division into thirds, ninths, and twenty-sevenths, extends the mathematical knowledge of the child — the subdivision introducing him to fractions and to the forms of the inclined plane. The elements of geometry are inculcated through the uses of this fifth gift. The ideas of multiplicity and diversity are fixed in the child's mind.

The forms of knowledge developed in this gift have reference not only to the addition, subtraction, and multiplication of units, but of



fractions. The child learns that two halves of a cube form a whole; that the half of 27 cubes is $13\frac{1}{2}$ cubes; that $\frac{1}{4}$ of 27 cubes is $6\frac{3}{4}$ cubes; that $\frac{1}{12}$ of 27 cubes is $2\frac{1}{4}$ cubes. He learns these facts not from dry and unintelligible figures on a slate, but from the little playthings in his hands. He can count the quarters of a cube, because he sees them before him. He should be encouraged to count them over and over, to make every possible division, until the relations of these parts one to another, and to the whole, are firmly fixed in his childish mind. Advanced pupils can be taught to make complex geometrical figures, such as an octagon formed of eighteen triangular pieces, and having a hollow center; an oblong of three by nine cubes, which can be changed into a rhomboid, and again into a trapezoid. By dividing the trapezoid into two equal parts, and rejoining them, a pentagon can be made. The entire cube can be made into an oblong hexagon, or an oblong octagon two cubes high, or a pentagon three cubes high with three right angles.

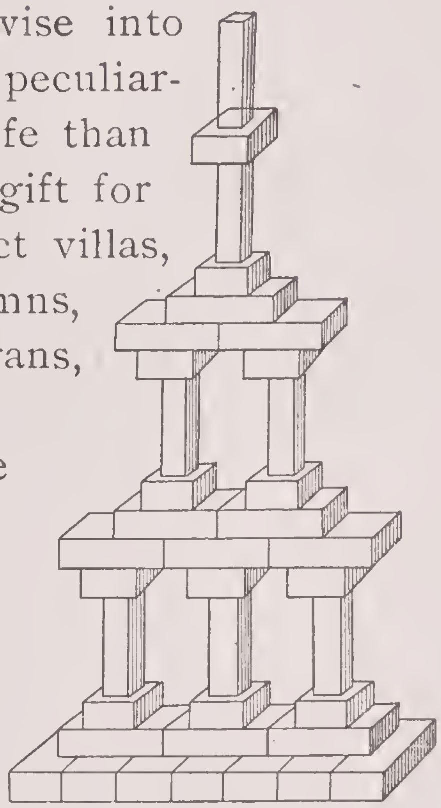


The forms of beauty admit of the most complex treatment, every variety of kaleidoscopic design being possible through the combinations of cubes and triangles.

The forms of life in the fifth gift are equally complex and varied. The child has now become a master-builder. The triangles furnish him with sloping roofs; and with a variety of forms hitherto unknown to him. Castles and towers, and three-storied houses, rise beneath his hands.

## SIXTH GIFT

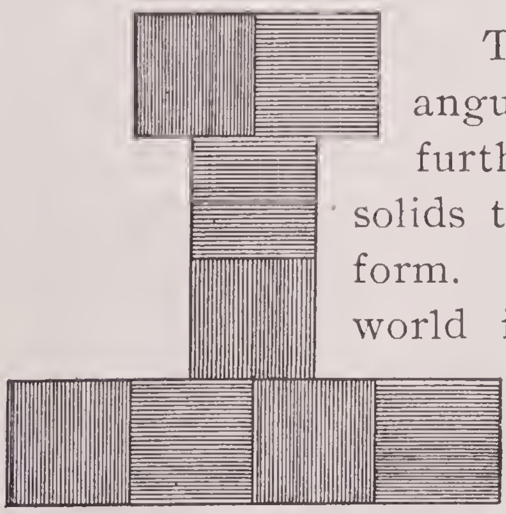
The sixth gift is a cube divided into twenty-seven oblongs, of the same size as those of the fourth gift. As the fifth gift is a development from the third, so is the sixth gift a development from the fourth. Three of these oblongs are divided lengthwise, each into two equal pillars; six of the oblongs are divided crosswise into twelve squares, making thirty-six pieces altogether. The peculiarity of this gift is that it admits of many more forms of life than forms of beauty and knowledge. It is preëminently the gift for the advanced child architect, out of which he can construct villas, pedestals, park-gates, triumphal arches, monumental columns, look-outs, stoves, kitchen-closets, book-cases, church organs, baptismal fonts, and high altars.



The most important characteristics of the sixth gift are

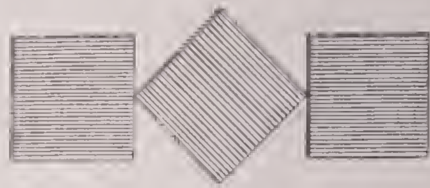
*a.* Irregularity of division.
*b.* Introduction of column.
*c.* Extent of surface covered by symmetrical forms.
*d.* Greater inclosure of space in symmetrical forms.
*e.* Introduction of distinct style of architecture.
*f.* Greater height of life forms.
*g.* Severe simplicity of life forms produced by the rectangular solids.

## SEVENTH GIFT

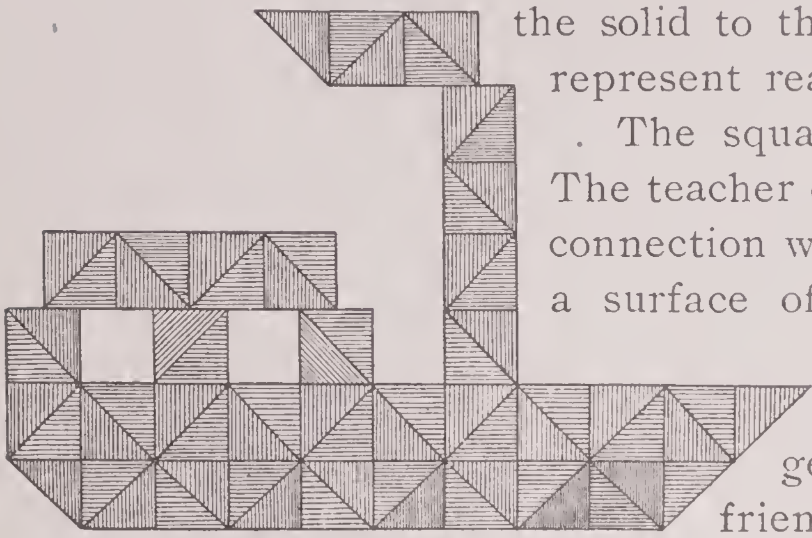


The seventh gift consists of square and triangular tablets. In this gift, the child passes still further from the concrete to the abstract; from solids to planes; from the form to the idea of the form. He is prepared by this gift for the abstract world into which he is introduced when he goes to school. Froebel understood that the abrupt transition from the nursery of concrete playthings to the school of abstract ideas and conceptions is often injurious to the child's mental growth. He wished to make that transition as natural and as easy as possible, therefore he originated the gift of tablets.

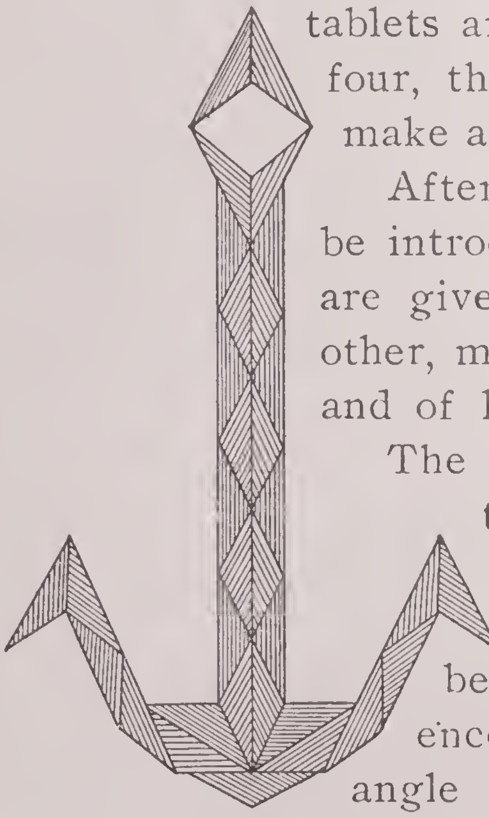
This gift is the direct outgrowth of the others. In the first gift of six balls the child was introduced to color and to perfect form; in the second, the ball, cylinder, and cube, to ground-forms of contrasting shapes; in the third, the divided cube, to a whole and its parts, similar in form, but differing in size; in the fourth, to difference of form in the parts; in the fifth and sixth, to still greater differences of form in the parts by the subdivisions of the whole.



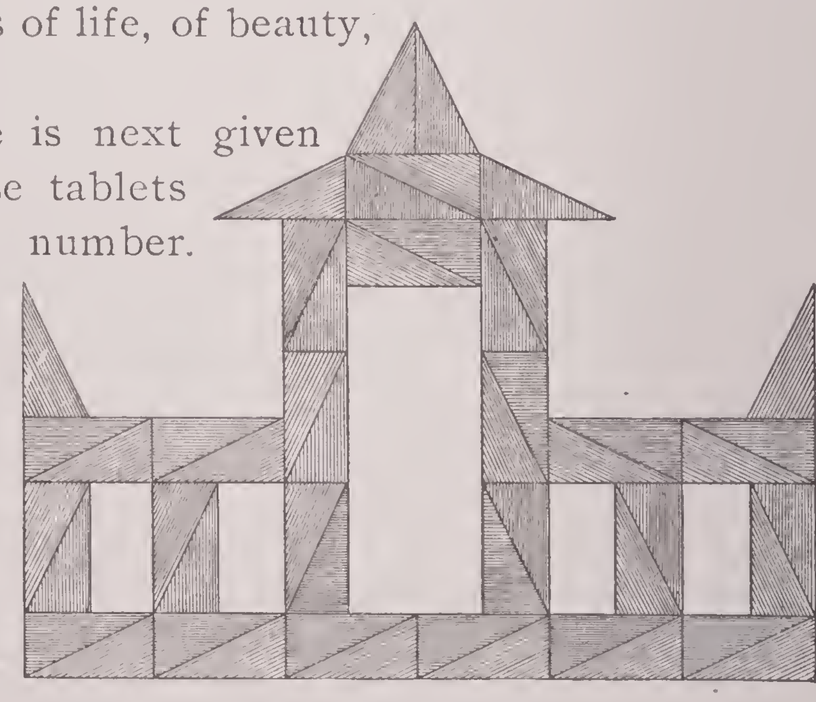
Up to the seventh gift, the objects are solid bodies; with this gift begins the spiritualizing of the material by the transition from the solid to the plane. With the tablets the child cannot represent real objects, but only pictures of objects.



The square tablets are first presented to the child. The teacher or mother must impress upon his mind their connection with the cube by placing one of them against a surface of the cube, and then removing it, as if it were a section of the solid body. Next two square tablets should be placed together, that the child may recognize an old friend, the oblong. Every combination of the two square tablets should be attempted by the child before the three square tablets are given to him. After having had three, he should have four, then six, then eight. With the eight square tablets he can make a great variety of forms of knowledge, of life, and of beauty.



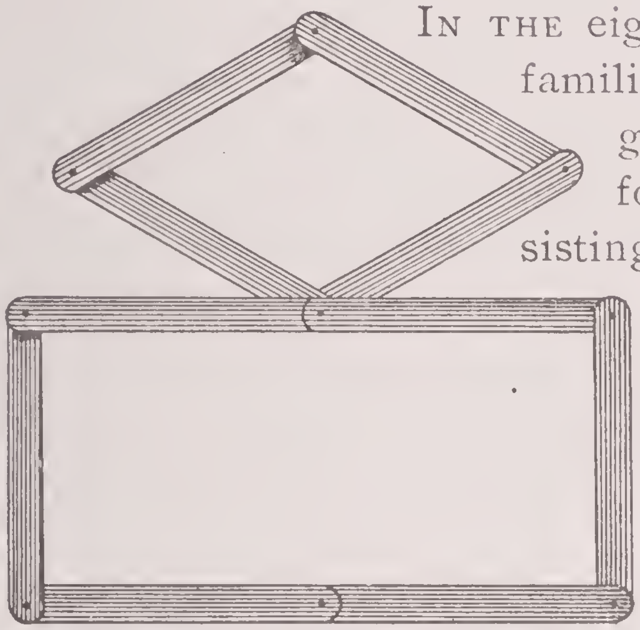
After he has thoroughly mastered the square tablets, he should be introduced to the right-angled isosceles triangle. Four of these are given him at first, then eight. He combines them with each other, making further forms of life, of beauty, and of knowledge.



The equilateral triangle is next given to the child. These tablets should be nine in number. The child should be shown the difference between the right-angle triangle and the equilateral triangle, and should be taught to combine these triangles into forms of life, of beauty, and of knowledge. The child is next introduced to the right-angled scalene triangle, or right-angled unequal-sided triangle. A vast number of combinations can be made from triangles of this shape.

The obtuse-angled triangle is next given to the child. This is the fourth and last of the series of triangles. After combining the triangles of this form, all four forms of triangles may be used with the squares to make mathematical designs or forms of life, or of beauty. By coloring the tablets, many beautiful kaleidoscopic effects may be obtained.

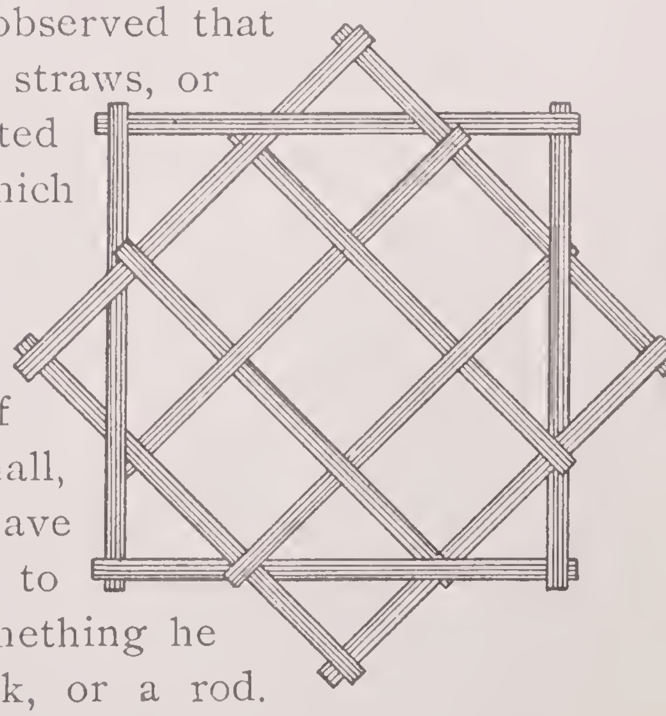
## EIGHTH GIFT



In the eighth gift the child, being now thoroughly familiar with the plane, is introduced to a still greater abstraction, the line. This is found in the connected slat, a form consisting of ten slats, each four inches long and half an inch wide; each overlaps the next one at the extreme end, and is fastened to it with a rivet. All the slats may thus be folded together, or be moved into various forms such as right angles, acute and obtuse angles, triangles, pentagons, squares, trapezoids, etc.

## NINTH GIFT

The ninth gift is the disconnected slat, and the use to be made of it is slat interlacing. In this gift, as in the others, Froebel has considered the natural instincts of children. He observed that they plaited grasses together, or willow sticks, or straws, or rushes. He gave them, therefore, the disconnected slats of various sizes, widths, and textures, by which they could gratify their love of plaiting.

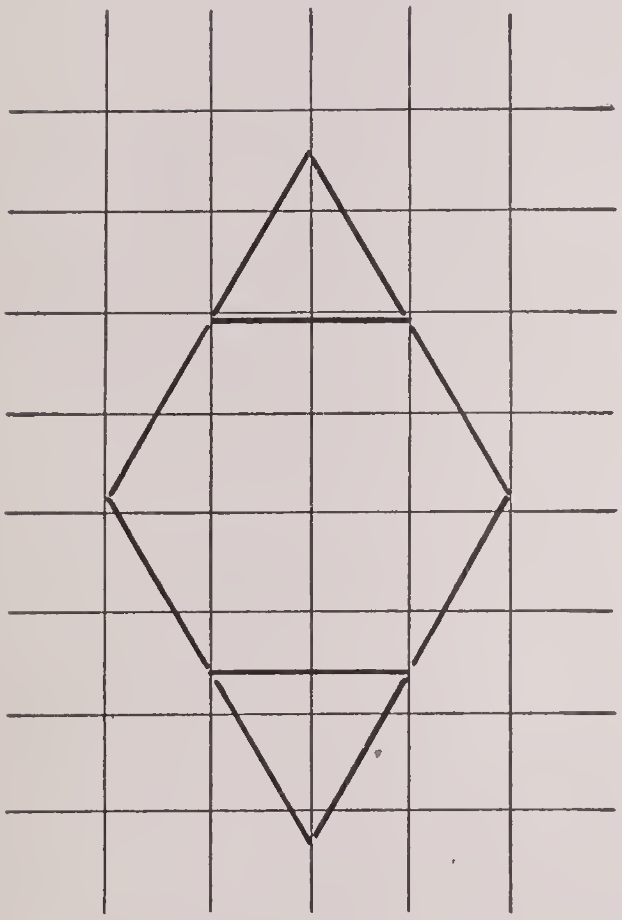


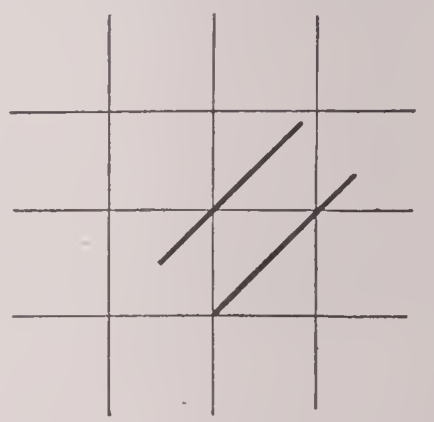
Slats may be given in bundles of ten or twelve, and may be of wood or of paper. If of paper, many colors can be employed, and much variety of design be thus secured. The wooden slats are small, elastic, and easily handled. The child should not have too many of them at first. One should be shown to him, and he should be asked to compare it to something he has seen. He may say it is a rafter, or a plank, or a rod. When he has become interested in its qualities, he should then receive another little slat and be taught to place them at right angles to each

other, to make a right angle with them; then an obtuse, then an acute angle; then to place them parallel to each other. When he has exhausted the combinations of two slats, he should have three, and be taught to make a triangle of them; then four, and be taught to make a square. With five he can make a pentagon; with six, a hexagon, lattice work, and a variety of other forms. Additional slats give him additional scope in the forming of designs.

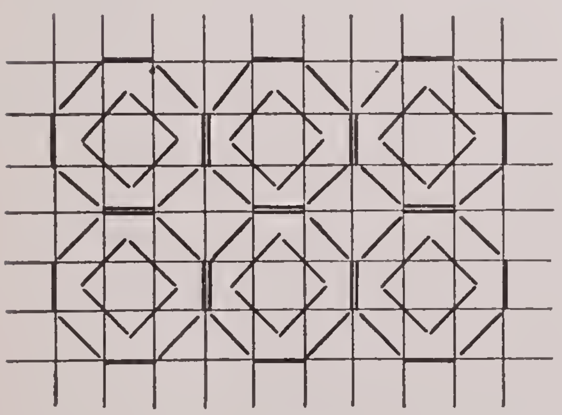
## TENTH GIFT

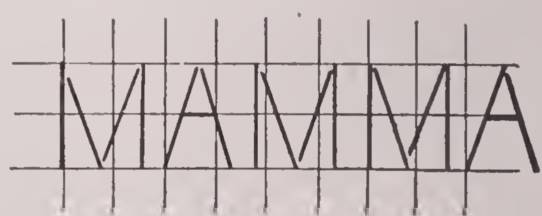
THE tenth gift consists of a number of little sticks, which may be one, two, three, four, or five inches in length. These sticks should be given to the children in bundles of five and ten. Before beginning to play with them, the kindergartner tells the children how the little stick was once a part of a tree in the forest; how the tree was cut down; then sawed up into logs, and the logs then used for many things; for planks and boards, and even for the little sticks, so that the little sticks really came from the great forest tree. The children should be asked what the little sticks look like. After their interest is awakened, then they should proceed to lay the sticks. Two sticks should first be laid in as many relative positions as possible; then three sticks should be used; then combinations of four should be made; then of five, and six, and eight; then of ten.



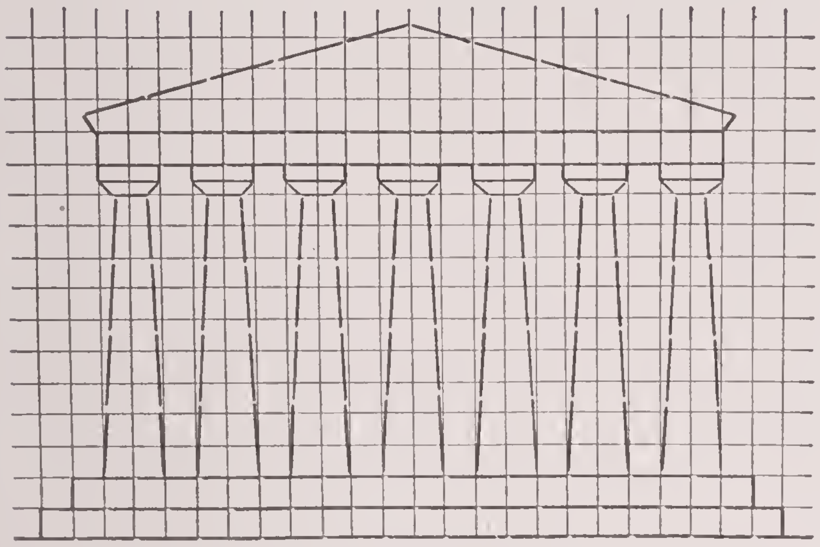


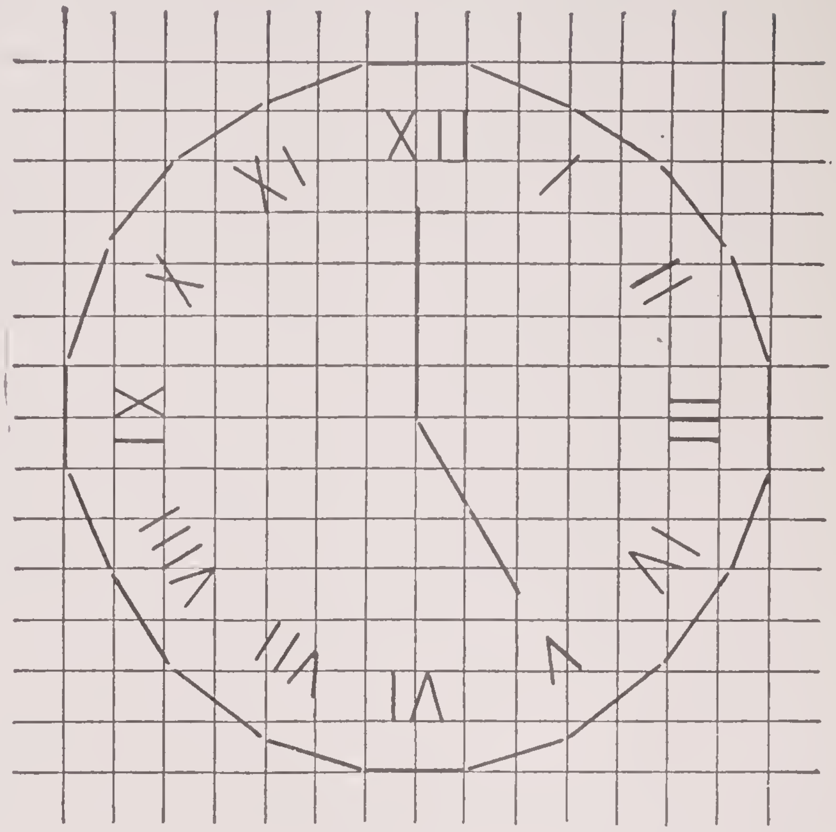
Addition and subtraction may be taught by means of the sticks. The ten may be placed in a row, and three removed, or four removed, the child being called upon to state how many sticks remain. He may say "Three sticks from seven sticks leave four sticks" or "One stick and seven sticks make eight sticks." The Roman figures may be made; and the face of a clock, with two sticks for the hands. By moving these around the children can be taught to tell the time. Arabic figures and the letters of the alphabet can also be made, and the children thus be taught to spell.





Forms of life, chairs, tables, stars, steeples, bureaus, gable roofs, can be made with the sticks, the child thus learning the first principles of line drawing. More elaborate forms, such as the façade of a Greek temple, can

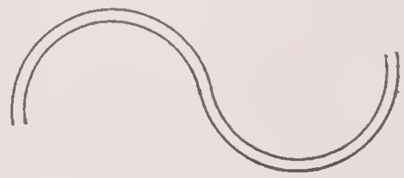


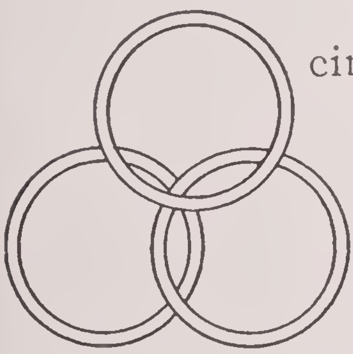


be attempted when the child has become expert in the manipulation of the sticks. He can also learn to make symmetrical patterns for a carpet or wall-paper design by repeating a set figure indefinitely. These figures admit of great variety of design.

## ELEVENTH GIFT

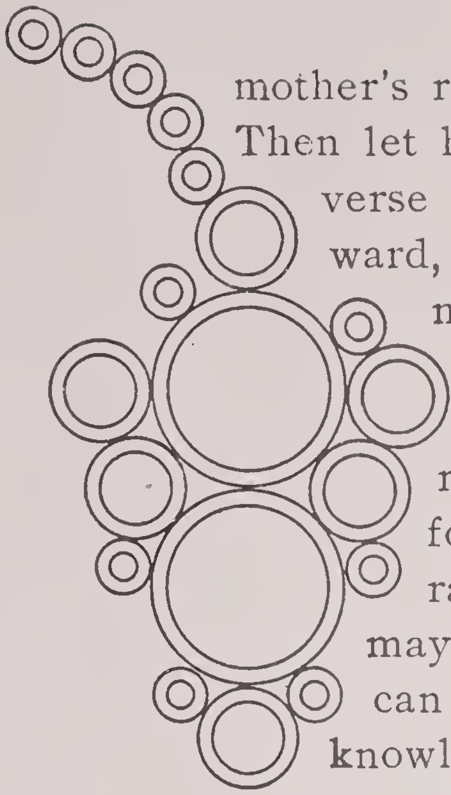
Of this gift Froebel wrote: "The Egyptian temples show us only straight-lined figures, which consequently show mathematical relations. Only in later times appeared the lines of beauty, that is, the arched or circular lines. I carry the child on in the same way."



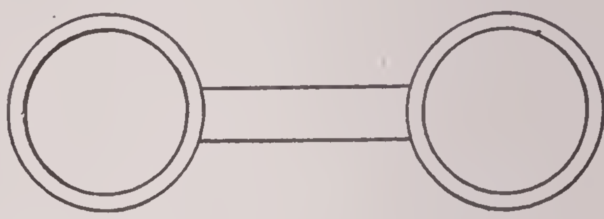


The material used in this gift are wire circles and half-circles of three different sizes, one inch, one and one-half, and two inches in diameter. Twenty-four rings of each size are contained in each box; and forty-eight half-rings of the three sizes corresponding to the whole rings. This gift embodies the curve, illustrating the circumference of the sphere, and the edge of the cylinder.

The mother or teacher should first tell the children what the rings are made of; then she should explain what a wonderful and useful metal iron is; how it enters into the composition of engines, stoves, fences, grates, gates, locks, and a thousand other familiar things. The child should first have one whole ring and two half-rings to play with; should be asked what the whole ring is like; what the half-rings are like. He may say that the whole ring is like a hoop, or like his

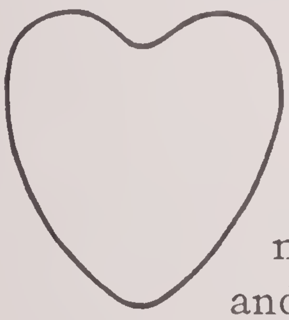


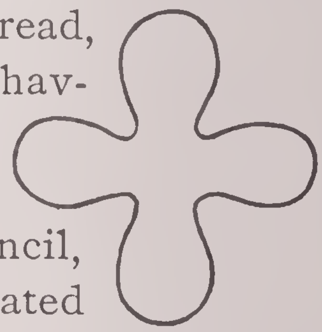
mother's rings, or like the moon; that the half-ring is like an arch. Then let him combine the two half-rings in various ways, making reverse curves, curves to the right, to the left, upward and downward, and opposite. Next he may make figures with two large rings, or with a large and a small ring, or with three large rings, or with three rings of graded sizes. He may then use four large rings; then five or six large rings. Such elaborate forms of life as a pair of scissors or a bunch of grapes may be made by combining rings of varying sizes. The rings can also be combined with sticks to make forms of life and of knowledge.



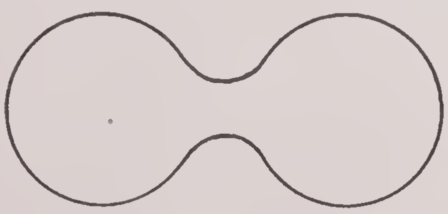
## TWELFTH GIFT

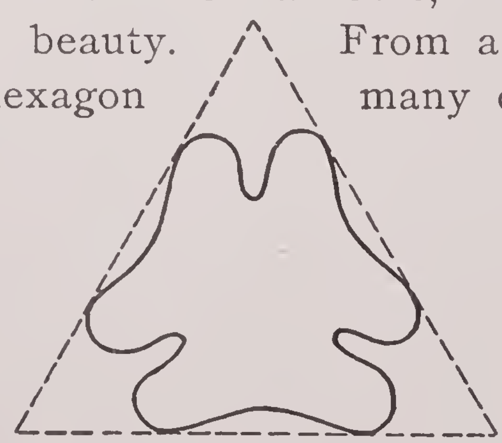
This gift, in which a wet thread plays the principal part, is of great use for teaching a child delicacy of manipulation. He needs first a red-colored cotton or worsted thread, about eighteen or twenty inches long, having its ends tied together, a slate the surface of which is cut through with a network of squares, a cup of water, a pencil, and a sponge. The thread is first saturated with water, until it is pliable and can be easily shaped to any form; then it is laid on the slate, and with the aid of a sharp-pointed pencil it can be drawn into a variety of beautiful designs. A square should first be made. By drawing the sides of the square toward the center, the design of a cross appears.

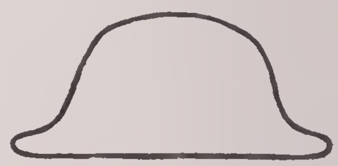




From a circle, a bean or heart-shaped figure can be made, or a ladyfinger, or a silk winder. From an oval, a dumb-bell can be made, or several designs of beauty. From a triangle, from a pentagon, and from a hexagon many designs of rosettes can be evolved. Forms of life, caps, gloves, shoes, bedsteads, chairs, cups and saucers, pitchers, etc., can also be made from the primary geometrical forms. The thread gift constitutes indeed a preliminary course in drawing. It trains the child's faculties, and prepares him for more serious work.

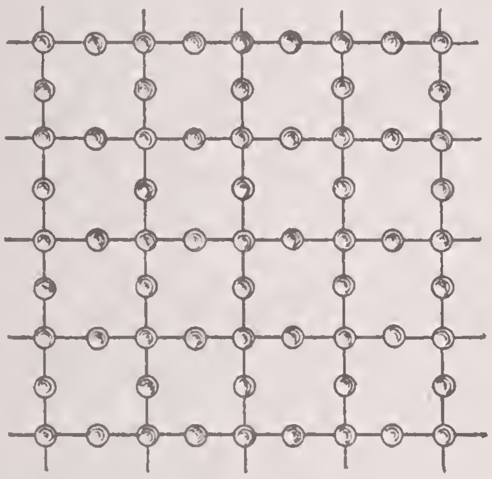


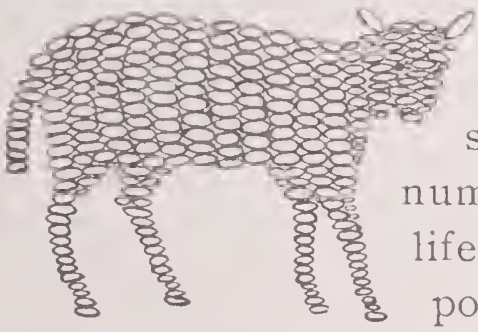


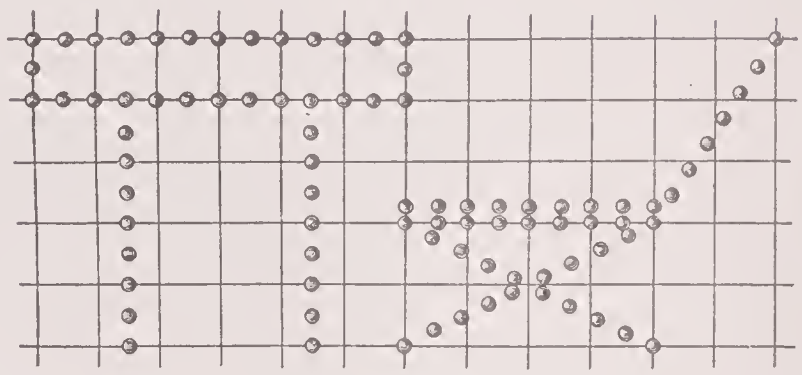


## THIRTEENTH GIFT

The thirteenth gift consists of the point, an abstraction which has in reality no dimensions, but which may be represented by something tangible, as a pebble, a seed, or a dried pea, by anything round and small, which the child can grasp with his fingers, and combine into designs. If seeds are used, the child should be told how they are planted, and what springs from them. Then the seeds should be placed in rows on the square lines of a table-top or slate. He may form first the outline of a square by placing four seeds at four corners; then these lines may be filled in with other seeds; then the lines which divide the square may be treated in the same manner. While the child is making the square, he should count the seeds, that he may have an even number on each of the four sides of the square, and an even number in each of the dividing lines. Forms of life may be made by placing the seeds in various positions on the squares; forming a bedstead, a ladder, a pair of scissors, a table, or a chair. As the child becomes more skilful, he can fill in the design, making a solid figure; a sheep may be made in this way, using white split beans for the body, sago and shells for eyes, ears, mouth, tail, and feet.







# THE OCCUPATIONS

Every gift and every occupation of the kindergarten is fitted to produce large numbers of finished articles that are either useful, or beautiful, or both. The number of such articles in the aggregate creates an embarrassment of riches. All of these should be put to some use, for it is one of the first principles of the system that there shall be no waste, and therefore none of them should be thrown away.

Because of some perception of this duty, in every family where there are several children who attend kindergarten there are appalling collections of useless, fragile, and yet precious articles. Yards and yards of paper daisy-chains hang about on gas-fixtures and collect dust. Red circles meant to represent apples, sewing cards without number, paper mats that have cost hours of toil and are of no avail, multiply past human endurance. Every little while the family is called upon to go into ecstasies over some new specimen of the child's skill in pasting and cutting, and if the ecstasy is a trifle late in putting in an appearance, a little lip trembles and bright eyes are veiled in tears.

There is no escaping the fact that the things must be welcomed and preserved. Costing about two cents apiece in money, they cost incalculably in effort, and have a genuine value, both as proof of the child's loving good-will, and as a record of his advancement. Provide, then, a place for their orderly bestowal. The portfolio is excellent for the cards and flat articles; a large box containing smaller boxes, each duly labeled, for the things which must not be crushed. The chains and pictures may hang about in plain sight for a day or two, and then be carefully put away for future reference. Each article should be dated. Such care reacts upon the quality of the child's work. He feels that his effort is honored, and that therefore a greater effort may be worth while.

When such a festival as Christmas approaches, the child worker has the most eager interest in the coming event. There are many friends to provide for, and he may make for each some gift, in token of love. Under all circumstances, it is better for the giver to make his own gift if possible. The gift is in this case intensely personal. It comes from the child's hand and brain as well as from his heart. This is what a gift should be. "The gift without the giver is bare." A present that is merely selected in a store, and paid for with the

father's or mother's money cannot possibly have this sentimental value. Let the child, then, make his own presents, but let him make them well.

The making involves careful planning: First, there are presents to make for the family. Every person, from grandmother to baby, must be remembered. Then there is the tree, and indeed the entire house to decorate. The chains of alternate white and red papers, or other brilliant colors, may be used in great profusion for festooning, and no ornamentation could be gayer or prettier. Mats, transparencies, and other decorations are suitable for preparing the home

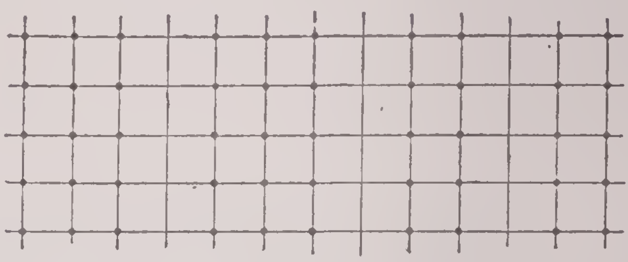
for the brief and mysterious visit of Santa Claus. This work will keep the hands busy,—and therefore out of mischief,—the mind active, and the heart happy for many weeks. The best part of it is that when Christmas comes it is found that no festival is so satisfactory as that in which the children bear a large part of the preparation. The warmth of heart, the cementing of love, pay back a generous return for all the time, money, and care which have been invested in this training.

## FIRST OCCUPATION: PERFORATING OR PRICKING

The general principles which underlie the occupations are the same as those that underlie the gifts, and the purposes also are in both cases the same. But they work by opposite methods. The gifts begin with the solid, and work down to the point, whereas the occu-

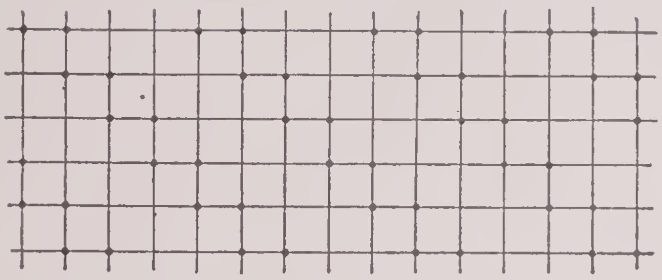
pations begin with the point, and by a process of synthesis, work through the line and the plain surface up to the solid. Thus we start with unity, and work through diversity back to unity. The gifts after their transformations return to the solid form from which they started, but in the occupations the transformations effect a change of the material itself, so that it cannot return to its original form.

The first occupation is perforating, and it deals with the point. The materials needed are:—



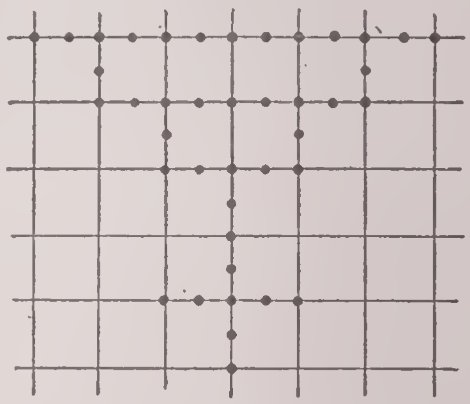
1. A needle. This should be about an inch long, the thickness of a darning needle, and firmly inserted, like a bradawl, in a handle.

2. A piece of cardboard covered with lines about a quarter of an inch apart and at right angles, the whole covering the cardboard with squares.



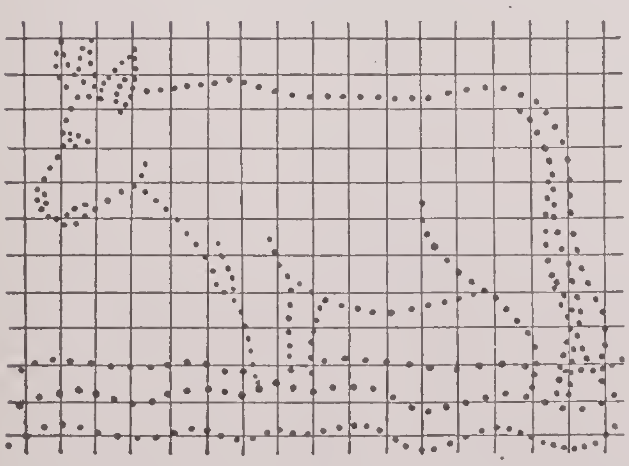
3. A perforating board made of thick felt or a dozen thicknesses of blotting paper. This should be about 7 x 9 inches in size. The purpose of this is to receive the needle as it passes through the cardboard.

In introducing this occupation, it is easy to rouse the children's interest by telling them about paper,—of what it is made, how it is made, what uses it serves, from the wrapping of a stick of candy to the manufacture of a car wheel.



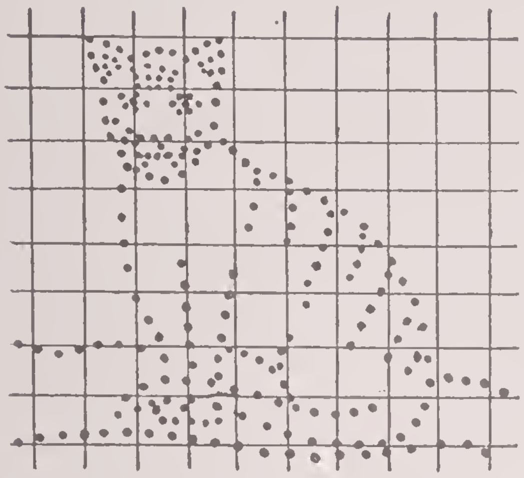
They will observe for themselves the differences in the paper, some coarse, some fine, some smooth, some like blotting paper, and they will understand how each kind is fitted for its own particular purpose.

A similar story may be told of felt, if that is used as a perforating board. The children are then told to hold the needle straight up and down, not slanting. This will make perfect work, and each child should understand the importance of this from the first.



At this point, the child should be taught to think before he acts. His impulse will be to perforate the cardboard first and think afterward, but when the correct habit is formed it will go with him through life. If he makes his perforation carelessly, it cannot be erased. After he makes the single perforation, the exercise may be varied indefinitely. He will perforate the dots from right to left, from left to right, from top

to bottom, and from bottom to top. Then he will perforate two dots and skip the third, then three dots and skip the fourth. He will also perforate diagonally in one row, diagonally in two rows, and so on almost without limit. Some idea of what may be done in this matter can be had from the accompanying illustrations.



When the first perforations are made, the child holds his paper against the light and, seeing the bright points of light, calls them stars. These never fail to delight the young worker. Some points of advice may here be given:—

1. Perforating should not be introduced too early — generally speaking, not before the age of five.

2. Do not let the children work at this too long at one time nor too often — say once or twice a week.

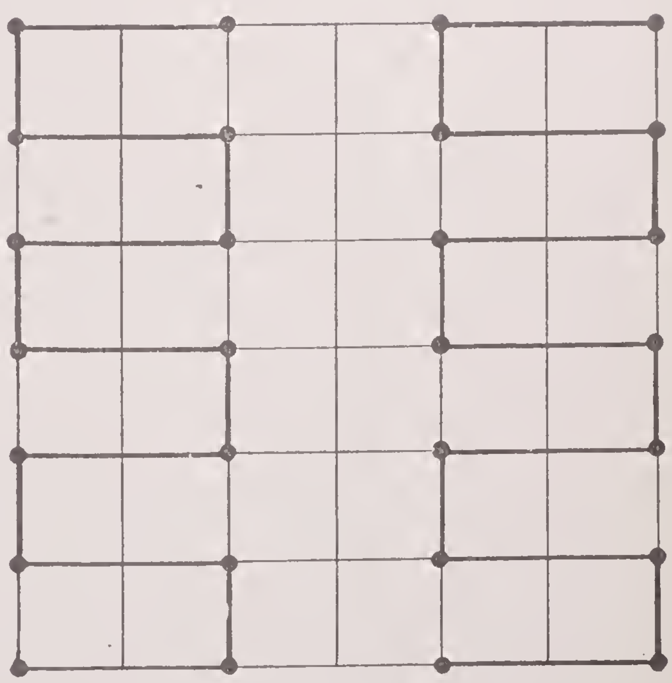
3. The light must always be good.

4. There should always be free conversation about the work. The conversation is a part of the instruction.

The finished work will be a pleasure to the child, and doubly so if he finds that it is a pleasure to others. It may be hung in the window or in some other way used for decoration, and that will lend it importance and dignity in his sight.

## SECOND OCCUPATION: SEWING

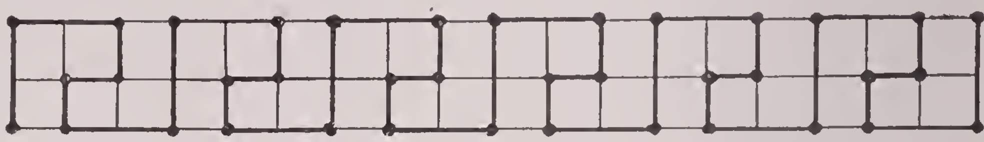
Sewing does not belong exclusively to civilized communities. It is universal. Even savages sew skins of animals by means of fibers which answer for thread. Embroidering is common among aborigines. Children are naturally interested in sewing. When the mother is engaged in this occupation, the child will be greatly pleased to be allowed to imitate her and have sewing materials himself. Sewing is naturally allied to perforating. It unites the training of the hand and eye. The eye sees the hole, and the hand finds it from the reverse side of the cardboard, and thus the two senses are educated together, while the needle is plied back and forth.



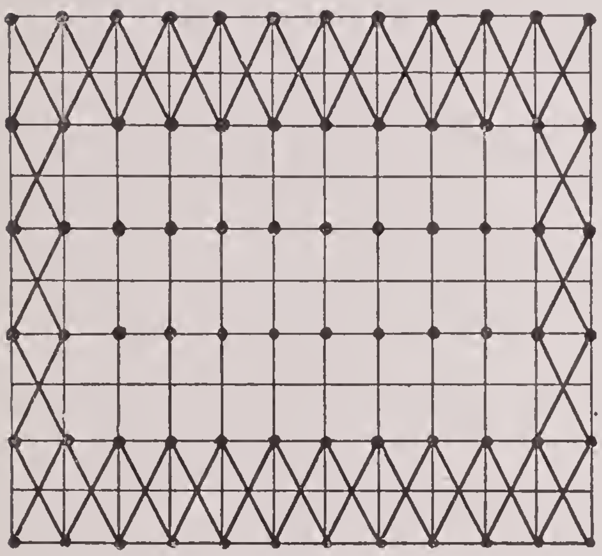
The materials for sewing include a large worsted needle, and threads of double zephyr, or knitting silk, of various shades and colors. The zephyr should first be selected for the child. At a

later date he may make his own selection. As soon as he can do so, with taste, he should be encouraged to do it, since this is an effective way of cultivating his sense of beauty.

The cardboard should not be punctured by machinery. This takes away from the child an important part of his lesson. He should perforate it for himself. The lines forming the design should be marked upon it, simply because the child cannot at first do it himself. But

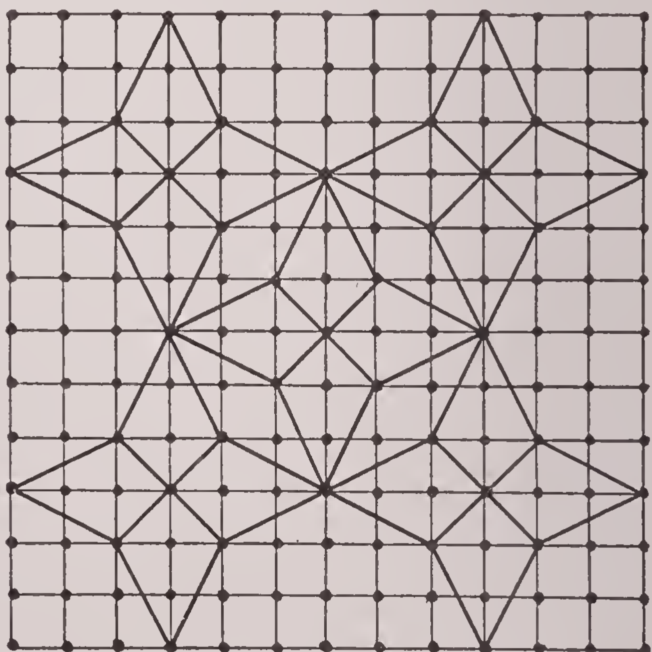


that which he can do, he should do. So let him begin with the perforations. However faulty his work is at first, let him never get away from the idea that he can do better and better. Let him keep in mind the beauty of the design, which he must not spoil by his carelessness. The child should also be encouraged to exercise his own inventiveness, and to make his own designs as soon as possible.



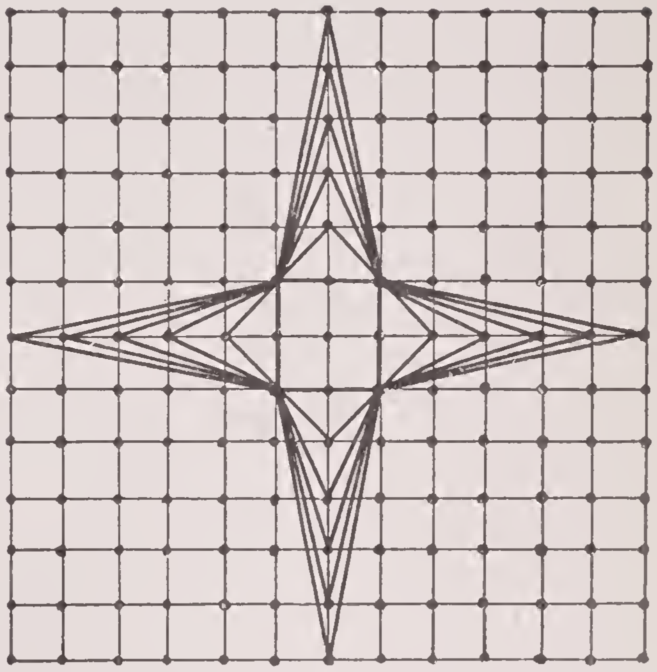
A conductor's punch makes holes of about the right size for the first sewing. The holes made by the needle perforator are too small. To sew through them strains the eye and taxes the young muscles of the fingers. Too close an application to small sewing has been found to lead to nervousness, and therefore in advanced kindergartens large perforations and double worsted, or sometimes baby ribbon, are substituted for the small cards and fine perforations originally used.

Leatherette is now sold at all the kindergarten supply stores, in a variety of soft and attractive colors. It is easy to perforate, and does not easily tear. Pretty and serviceable portfolios, pen-wipers, needle-books, and many other articles may be made from this useful material, suitably decorated with embroidered designs.

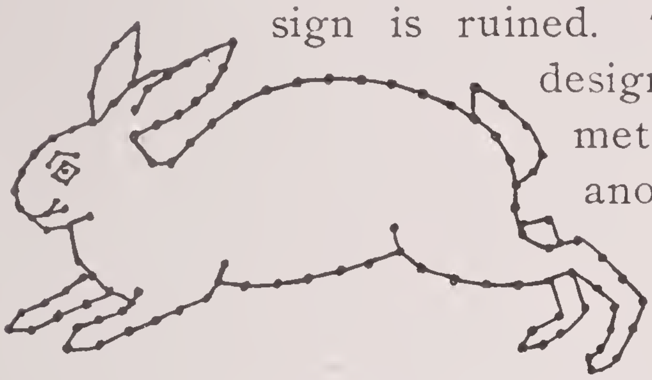


The purpose of the kindergarten sewing is to train the mind, not merely the fingers and the eye. Sewing, especially plain sewing, is valuable, in and of itself, but in the scheme of the kindergarten it is a means to an end — it is the means of training the mind. The parent or teacher must never overlook this purpose. Its educational value consists in its obliging the child to think, to be attentive, to count, and to plan.

The number of tasteful designs for the occupation of sewing is so great, that it is not possible even to catalogue them within the limits of this volume. A few patterns are here given, since a glance at them will give a clearer idea of what can be done than one can convey in many pages of written description. These patterns represent the first, the middle, and the later stages of this kind of work. It may be added that increased variety can be secured by the use of a diversity of colors.



First among the lessons that may reasonably be taught by means of the second occupation, is order—Nature's first law. In this occupation everything must be done according to rule, or the result will be spoiled. Then comes an appreciation of the importance of number. The worker must count correctly, and if he mistakes a perforation the design is ruined. The next lesson is symmetry. These designs are so arranged as to form a symmetrical whole, one part corresponding with another. Accuracy and neatness follow. If the colors are to blend harmoniously, the needle must be inserted precisely at the proper place. Then the thread must not be pulled impatiently or jerked, as it may tear the card, or snarl the thread, or otherwise injure the work. These intellectual and moral results of the second occupation prove its importance, from an educational view of the work.



## THIRD OCCUPATION: DRAWING

A KNOWLEDGE of drawing is useful to all people, not to artists only. The ability to express ideas in this way is of value to architect, carpenter, gardener, cook, tailor, or teacher. The child has an instinct for drawing. He loves picture books. He loves the rudimentary pictures with which his mother embellishes her stories and songs. From earliest infancy this instinct is displayed. When the window pane is clouded with mist, the baby loves to draw his fingers over it, streaking it for the housekeeper, but making rude pictures which perfectly express his own mind and are a source of keen satisfaction to him. If the mug of milk is spilled on the table, the child is almost certain to draw his finger through it, thus again making rude pictures. The blackboard, which ought to be in every

nursery, is used almost every day, and many times a day. This shows that the child has an inborn desire to represent by the means of drawing the ideas that crowd his mind.

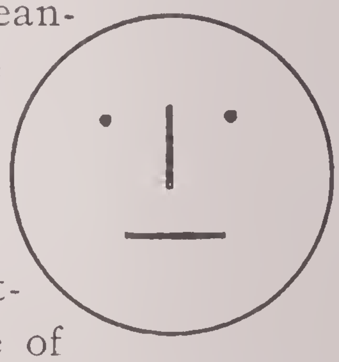
Of this instinctive desire Froebel says: « This inner demand of the child to produce and draw, to show what he can create, is in conformity with the creative power of nature, which brings forth everything from air, light, and earth. It is in drawing, particularly, that the child proves himself to be a free and capable creative being. While thus occupied, he does not need to use much physical force, and has a material which he can easily master: hence we are enabled to see what his power of will, his mind's eye, desires to create. Drawing, therefore, is a most important means of culture, and as such demands·—

Observation,
Attention,
Recollection of what has been seen,
Power of invention,
Logical thinking.

Drawing enriches the mind and spirit with clear ideas as well as correct and beautiful forms, and demands a free, active use of the senses — in particular, sight and feeling."

The child will begin with the easiest form of drawing, which is in outline. Let him place his hand on the slate and draw the outlines of it. A few simple marks may be added to his outline to represent the nails and wrinkles of the knuckles, and the finished product will be a source of delight to the child. Then he will outline various other objects, such as a coin, a pair of scissors, a table knife, a key.

The child loves to have his chalk or pencil go round and round. Utilize this desire. Let him make such marks on the blackboard or on a piece of paper; it is easy to give meaning to the circular marks by inserting a couple of ovals and calling the whole a picture of a bird's nest. A circle may be made into a fair picture of the moon by the addition of two lines and two dots. A very satisfactory picture of a kitten may be made by the use of two ovals and a few curved lines. And a fish, since cats like fish, will be an interesting addition.



After this the child will draw certain things which he can see only in imagination. This imaginative drawing, so long regarded as of the least importance, is in reality of the greatest. It is the beginning of

creative art; and that it shows itself long before accurate representation of commonplace objects, is significant of its final place in the scale. We have come to know that these earlier impulses are the most important. It is as if the faculties,— of self-preservation and imagination, for example,— which were most necessary to our adult life, most necessary to the life of society, struck the deepest roots. The early appearance and the persistence of imaginative drawing, therefore, point to its value. Mere copying should never be allowed to take its place; but closer observation, a nearer approach to truth, should be encouraged.

Many plans for instruction have been worked out, some of them based upon charts that can be secured from any good supply store. But much better than any such artificial progression, are the child's own spontaneous efforts to represent what he sees, or express what he imagines. Help him to a stimulating dissatisfaction with what he has accomplished, and encourage him to observe more and more closely. The first attempts at a horse, for example, will probably be little more than a body, a head, and four legs. Presently the tail will be added, then the ears, the eyes, the hoofs. The body will round out, and the front legs be differentiated from the hind legs. Little by little the rude outline will increase in accuracy, and the horse will begin to show signs of life and motion. This natural evolution upon the blackboard is the picture of the evolution of an idea. To force a true picture of a horse upon the board, before there is a true image within the mind, is to inculcate a kind of formal hypocrisy.

The educational influence of such drawing is not far to seek. While the child is producing these various forms, his fingers gain skill, his eye is trained in accuracy, and his mind is busy in creating or developing ideas. He first sees, then does, then knows; he learns by doing, and his knowledge is his own. The work is creative and, therefore, strengthens his power of will. Froebel says of this: —

«As the drawing of lines precedes the drawing of figures, so also there proceeds from it the invention of forms, ascending to imitation and copying; and further, after the pupil has made the required progress in geometry and mathematics, perspective drawing, instruction regarding light and shade, as well as drawing from nature, landscape drawing, etc., will follow. The last aim here, as everywhere, is the representation of man, *i. e.*, the representation of the human figure.»

Against this logical deduction of Froebel, however, stands the practical experience of the mother and teacher — of all who have ever observed children. Almost the first thing the child attempts is the human figure. It is the thing he is most interested in, and therefore

he does his best to express that interest. His drawing seems to be an effort to grasp his impressions more clearly by uttering them. He draws a picture of a man, compares it with the real man, perceives its inadequacy, though, of course, very vaguely. He finds, perhaps, that the real man has fingers, which his picture-man is without. He adds the fingers, compares again, and so studies the man as he studies the horse. First comes his interest in man, then in animals, then in surroundings, and probably last of all in the flowers and pretty designs which he is usually expected to do first. Froebel is nevertheless right in his conclusion, for the final aim of all art is indeed the representation of man; but it is not the representation of the human figure, but the expression of the human spirit — the human spirit in contemplation of itself and of the world it lives in.

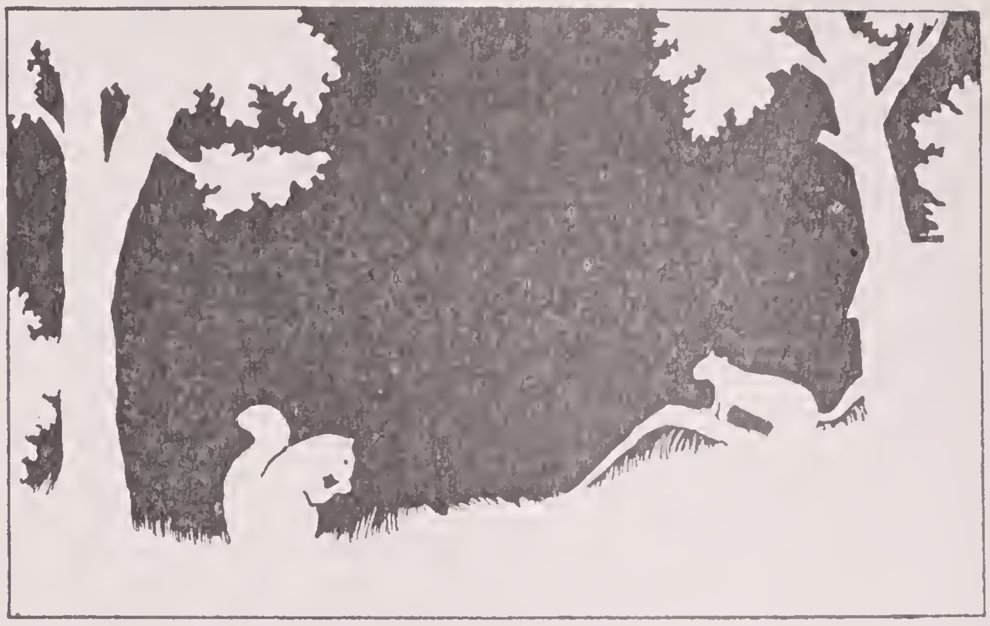
## FOURTH OCCUPATION: COLORING AND PAINTING

Color is introduced into the kindergarten with the first gift, in which the six balls are of six different colors. It presently becomes evident, however, that this is not enough. The love of color, roused by play with the balls, as well as by increased appreciation of the similar colors in the natural world, must be utilized — it must bear fruit in action. Merely to contemplate and enjoy color is sensuous at best.

Therefore the children in kindergarten are supplied with colored crayons, boxes of water-colors, and blocks of drawing paper. The colored chalks give the quickest results, are soft, and easily used. But they get on the floor and the clothes, and children cannot be left safely in possession of them without some older person in charge. The water-colors, also, demand attention from the mother or teacher, but the result of unwatched work is not quite so disastrous. The chalks are chiefly used for blackboard drawing but they may be effectively used on coarse brown paper. The water-colors lose half their value if not used on drawing paper.

One of the simplest and most effective forms of painting is the stenciling of leaves and branches. In the autumn, when the children are eagerly collecting the bright-hued leaves, let them take a maple leaf and lay it upon a piece of drawing paper which has previously been prepared, by having been washed over with clear water and then allowed to dry. Fasten the leaf to the paper,— which in its turn should be laid upon a drawing board,— by means of small pins. Then take any chosen color and fill the space around the leaf with

a solid wash. Gold paint is particularly effective when applied in this way and children especially delight in it. After the painting, of course, the leaf is to be removed, leaving behind a white picture of itself against a colored background. The veins of the leaf may then be painted in.



Cardboard figures of animals and people can be cut out by older persons and treated in the same way. By grouping the various figures, all sorts of attractive designs may be formed. By washing the lower part of the paper in brown and the upper part in blue, men and animals will seem to stand upon the ground, with the sky behind them. The juncture of the brown and the blue will then be the first suggestion to the child of the way to represent the horizon line.

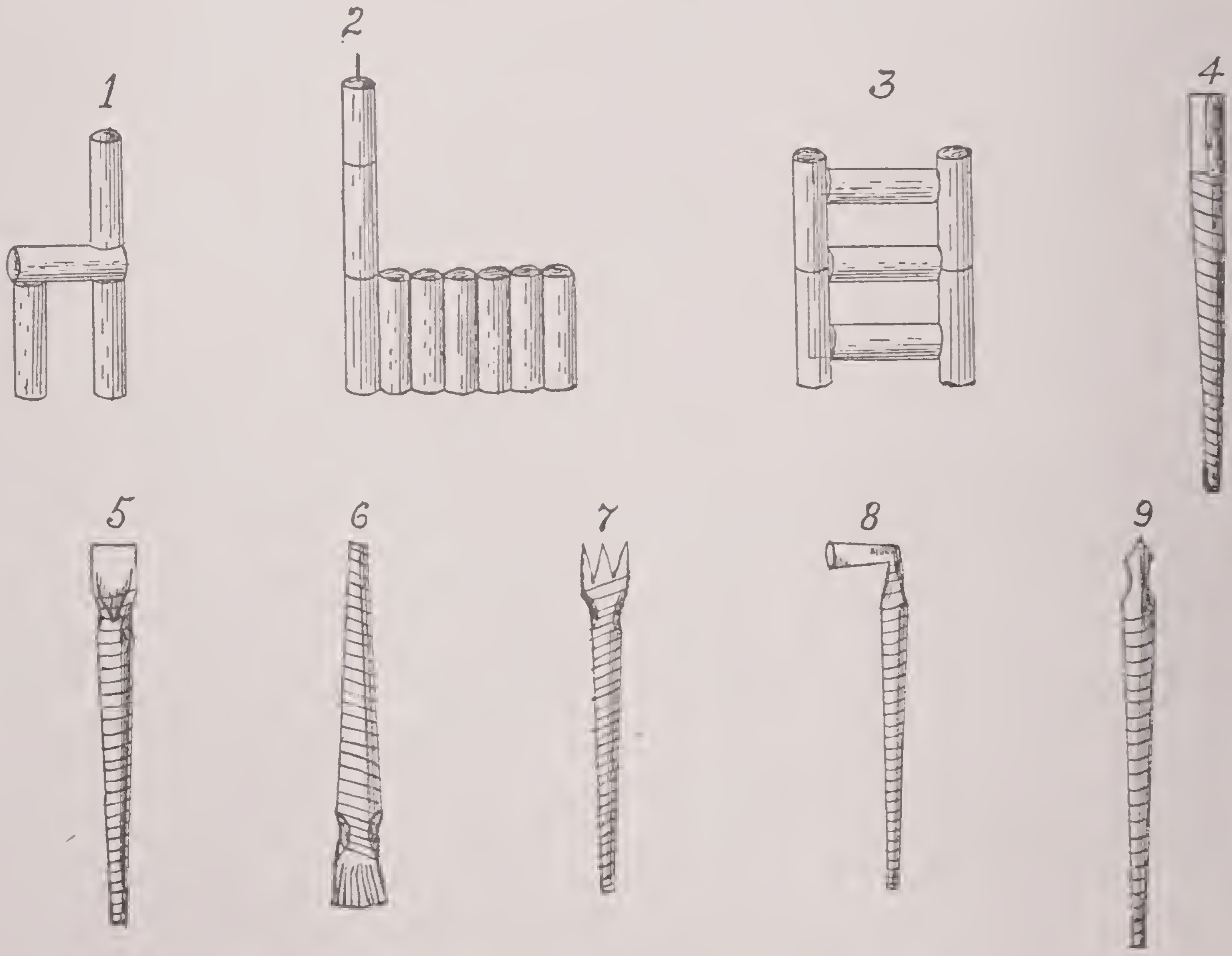
Stencil borders for the playhouse walls or for the ornamentation of the portfolio may be made by older pupils. In this case, a design is drawn upon cardboard, cut out with a sharp knife, and the color-wash applied through the openings. Very young children can do the washing in, the older children having made the patterns.

The use of painting is, of course, to represent the surface of things. Drawing represents the outline, modeling the form, and painting the surface. Stenciling gives the feeling for surface by what it does not do, rather than by what it does. The child's surprise at the result of this leaf-work is always complete. Repeated many times, he is bound to distinguish the idea of surface from that of outline, or of solidity, and thenceforward to deal with it more intelligently.

The way for real painting having been broken in this fashion, give the child his paints some day when he is full of a story he has heard. Help him to prepare his paper, for without proper preparation his efforts will fail to bring forth the best results. Give him a little bowl of clear water, brushes of two or three sizes, and an old piece of muslin on which to wipe them. Let his box be fitted up with paints that are of a fairly good quality. Most public school stores keep satisfactory paints for about thirty-five cents a box; no paints cheaper than this are worth buying at all. Having thus supplied him with ideas and materials, leave him to work out the problem of representation by himself.

As long as he is satisfied with objects in the flat or without perspective, let him remain so. When he progresses beyond this stage the directions in Volume VI. will be found helpful. In the earlier years he needs little more than the knowledge of the horizon line and the general fact that objects grow smaller as they retreat into the distance.

Those who have seen the painting by children who have not been taught, but encouraged to express themselves in color, are continually surprised at the excellence of the results. Faulty as the arrangement and perspective must be, and absurd as the coloring often is, the air of naïve life-likeness,—of a sort of primitive innocence,—which often characterizes these productions is most winning. But if the results on paper had no charm at all except for the young artist, the occupation would still have its great educational value. Not only would it open the eyes more fully to the world of nature, the heart to nature's secrets, but it would also open the mind to the great world of art.

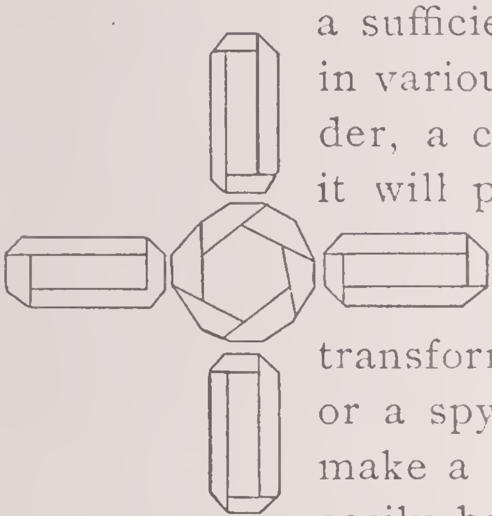



## FIFTH OCCUPATION: PAPER-INTERLACING

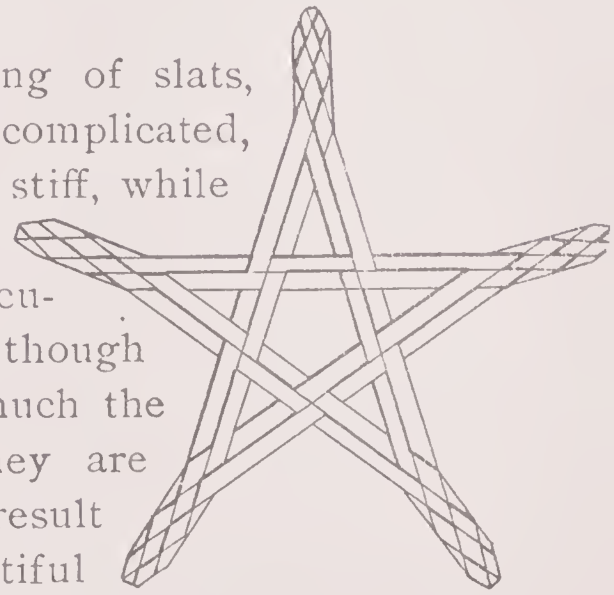
Paper-interlacing was first devised for the purpose of saving materials which would otherwise be thrown away. « No material," said Froebel, « should be thrown away as useless.» The materials are strips of white and colored paper about an inch wide and of various

lengths. What these represent in the first place will depend on the imagination of the child. To the girl, they are likely to be ribbons. The boy may fasten one to a stick and call it a whip, for an imaginary horse. Or he may fasten it around his waist and call it a soldier's belt.

The strips should first be rolled tight into the form of a cylinder and the outer edge be pasted to keep it in shape. When there is a sufficient number of these cylinders, they can be used in various ways. They may be arranged to make a ladder, a chair, or a church. If the strip be not fastened it will partly unroll itself and will thus represent curls, which children hang over their ears. If the inner end be drawn out, the cylinder will be transformed to a horn which may be called a trumpet or a spy-glass. If the end of this be bent over, it will make a hammer or a pipe. A penholder and pen may easily be made. If the large end is flattened it makes a shovel. If it then be fringed, it makes a broom. A fork may be made in a similar manner.



The interlacing of paper is similar to the interlacing of slats, the chief difference being that the former is more complicated, and therefore adapted to older children. The slats are stiff, while the paper is pliable and can be bent at will. Further, the corners of the paper must be folded, and for accuracy this requires great care. But in the two cases, though the material is quite different, the forms in view are much the same. The figures produced are geometrical or they are founded on geometrical figures. These combinations result in a surprisingly large number of interesting and beautiful forms. To describe a considerable proportion of these would occupy more space than can be given in this volume, and so a few cuts are here reproduced simply to show what can be done.



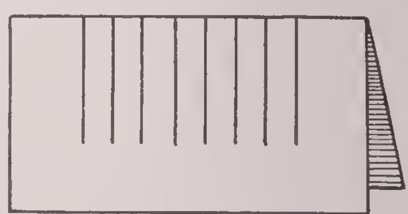
## SIXTH OCCUPATION: WEAVING

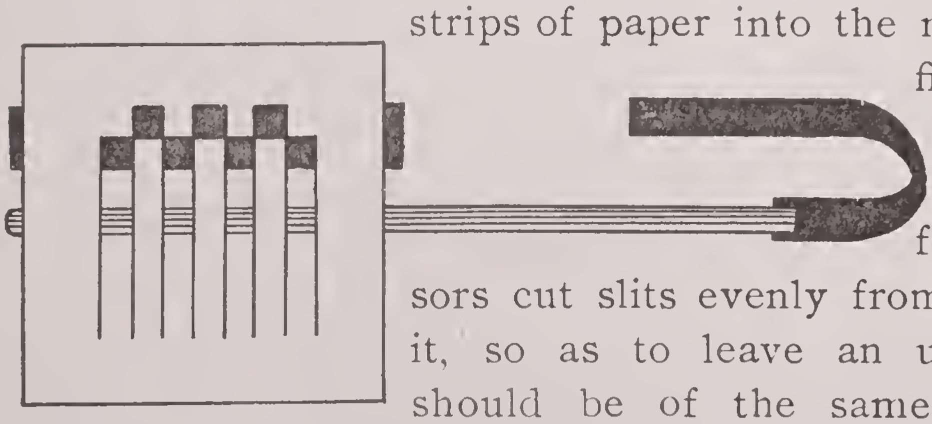
WEAVING is the art of producing cloth, or other fabrics, by so interlacing threads as to form a continuous web. The art is doubtless of ancient origin, for it is by this means that all clothing, except such as comes from the skins of animals, has been made. Its first forms were necessarily coarse, for reeds, rushes, and fibers, were employed in the place of threads. The intertwining of these, over and under, makes coarse mats. As experience gave skill, the threads could be

made longer and finer. So the first cloths were made. The child following the development of the race, must share in the occupations which educated it, and therefore he, too, begins to weave.

In these days, not only cloths but carpets and mats are woven in the loom. Threads of indefinite length are placed parallel, and these are called the warp. The transverse threads which are intertwined successively over and under the warp are called the woof or the weft. The shuttle is the instrument used for shooting the woof from right to left, forward and back. The threads now used are very different from the primitive fibers, and the fine silks of the twentieth century do not closely resemble the rude mats of prehistoric man, but they represent the evolution of these mats. Similarly, the child's crude weaving has, as a finished product, very little value; but his later clearness of thinking or completeness of sympathy represents the evolution of the ideas he gains by sharing the experiences of the working world.

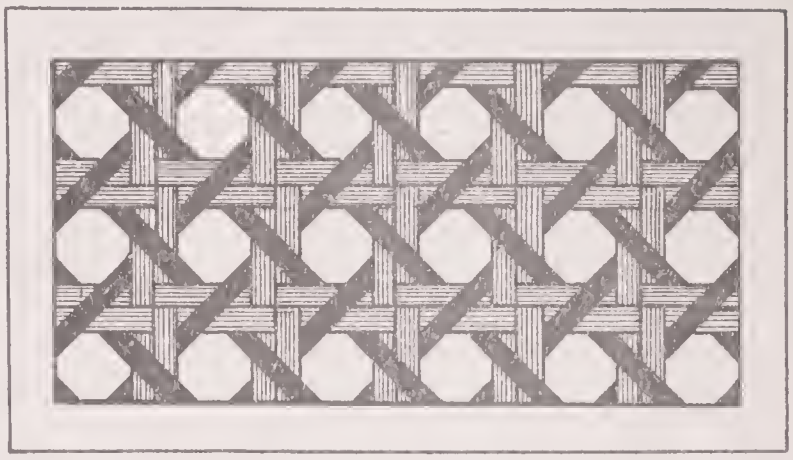
The sixth occupation of the kindergarten, mat-weaving, is the beginning of this good end. Besides enlarging his share in the race life, the occupation demands certain intellectual operations. It compels him to count, to group, to find contrasts, and to reunite these contrasts. He may make an immense variety of patterns; and thus he creates. It requires much care, but a very young child can succeed with some of its simpler forms, while it may still be a favorite occupation, up to maturity. It exercises both hands about equally, it satisfies the love of color, and it cultivates the sense of beauty. It thus furnishes an agreeable and educative occupation to the active, restless child.



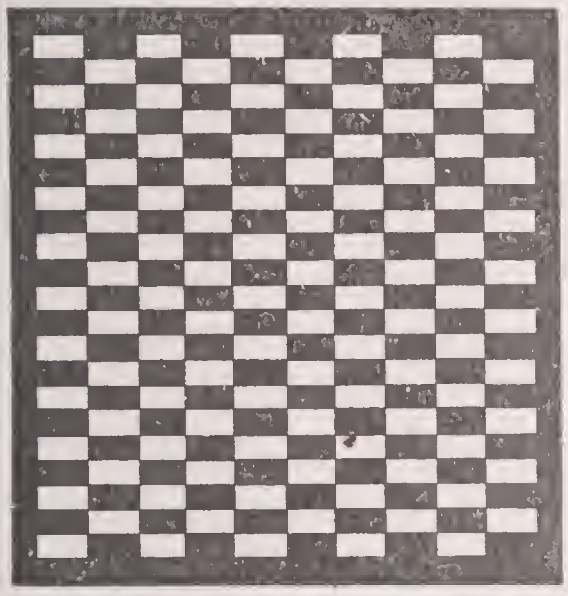


The simple materials for paper mat-weaving are two or more sheets of paper of different colors, a pair of scissors, some paste, and a weaving needle. The latter is a long, flat tool made of wood or steel, with an opening in one end for fastening the paper strips, and represents the shuttle. It is used for weaving the loose strips of paper into the mat. In weaving, first cut one sheet of paper into strips about a half-inch wide. Then take another sheet about 5 x 7 inches, and folded across the middle. With the scissors cut slits evenly from the fold toward the edge but not to it, so as to leave an uncut border all around. These slits should be of the same width as the strips already made. Fasten a strip to the weaving needle and weave it through the slits, alternately over and under them. A second strip should be woven in

the same way, but alternating the under and over. The ends of the strips are to be pasted to the borders of the mat. These processes are plainly shown in the illustrations given below.

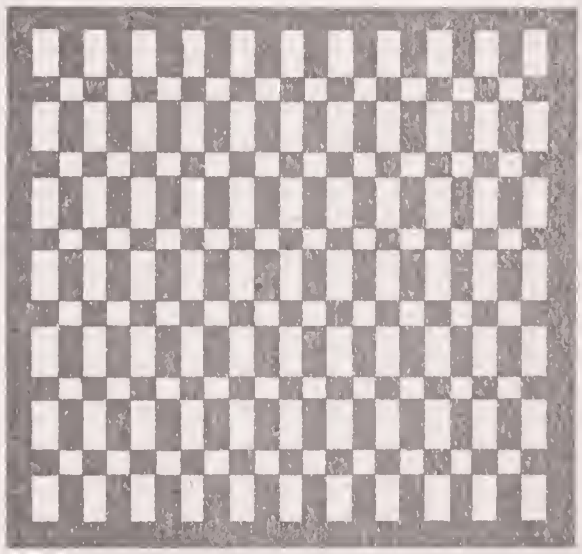


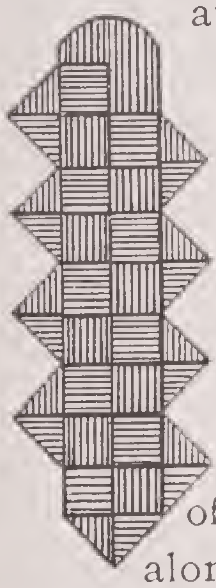
A variation of weaving is found in open-work patterns. The simplest form is made by cutting out every alternate strip from the ground work of the mat and omitting every



alternate strip of ribbon. Diagonal strips may be added and this will give the child the idea of the weaving of cane-bottom chairs.

A further variation of this occupation is found in what is called free weaving. In this there are no borders to hold in place the strips which represent the warp, and therefore it must be so constructed that no border will be needed. The simplest beginning is with a broad strip of paper slit through the middle from one end nearly to the other, and the strip is woven diagonally, over and under, back and forth.

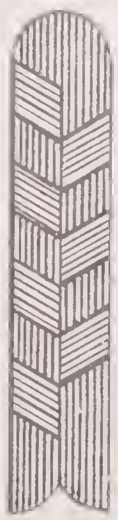


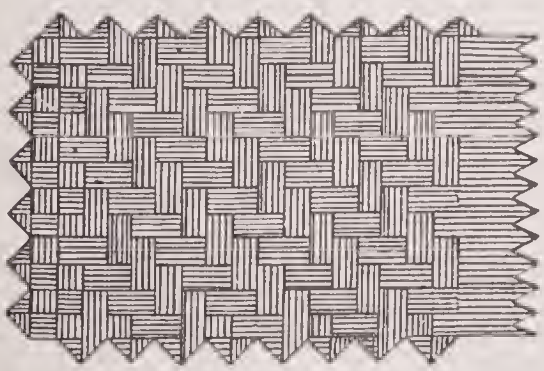


The next step is to imitate this broad strip by a narrow strip, so folded as to produce about the same effect.

The number of strips representing the warp may be increased at pleasure.

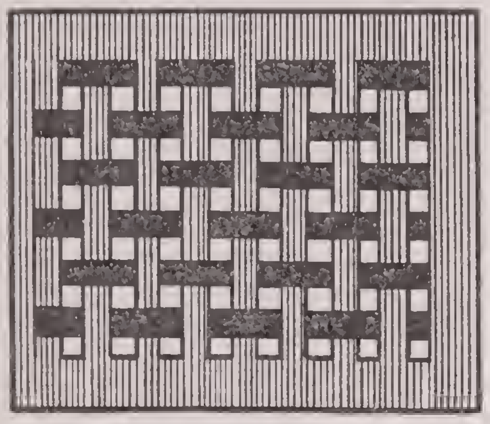
This weaving may produce book-marks, mats, baskets of five or six sides, round baskets, and various articles of interest. In all this, it is well to attend to the harmony of colors, so that the esthetic taste may be cultivated along with dexterity. The pupil should also be encouraged to invent designs of his own.

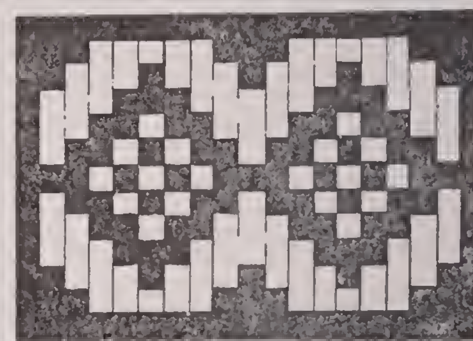




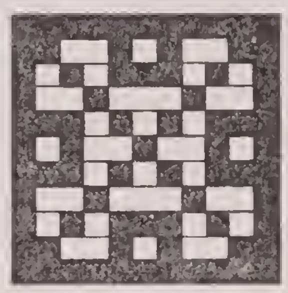
In many kindergartens, this weaving with strips of paper has been supplanted by weaving with cloth, braid, or strips of leatherette. A very good iron-holder, for example, is made by cutting slits in a square piece of felt, and weaving a piece of black skirt braid in and out of the slits. Any of the designs given for paper-weaving can be carried out in cloth or leatherette. The advantages of the latter

method are twofold: First, cloth or leatherette is stronger, and does not tear and spoil the work at a critical moment, as paper is likely

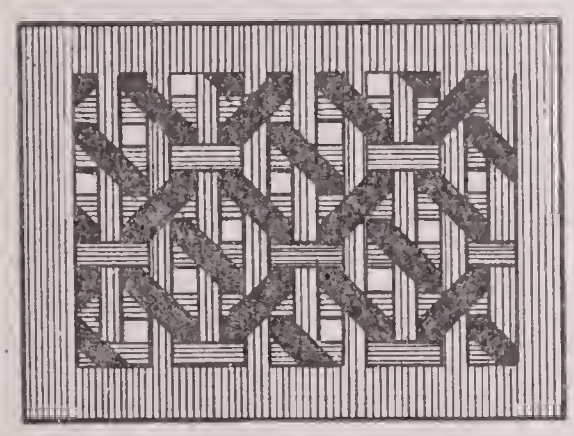


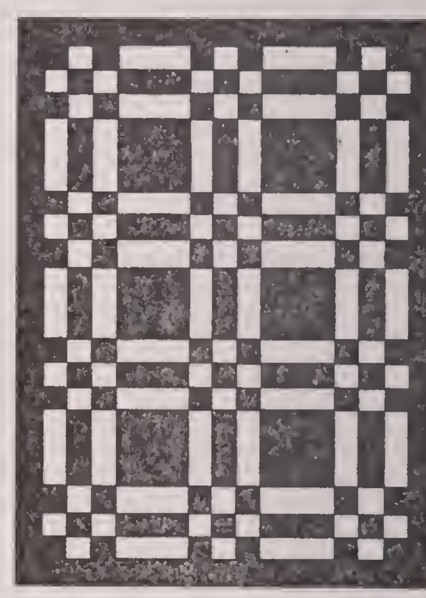


to do; second, the work, being larger, calls for the use of the large muscles of the hand and arm, and is less of a strain upon the eyes and nerves. Add to this the fact that the result is more durable and useful, and the advantages of the plan, are obvious.

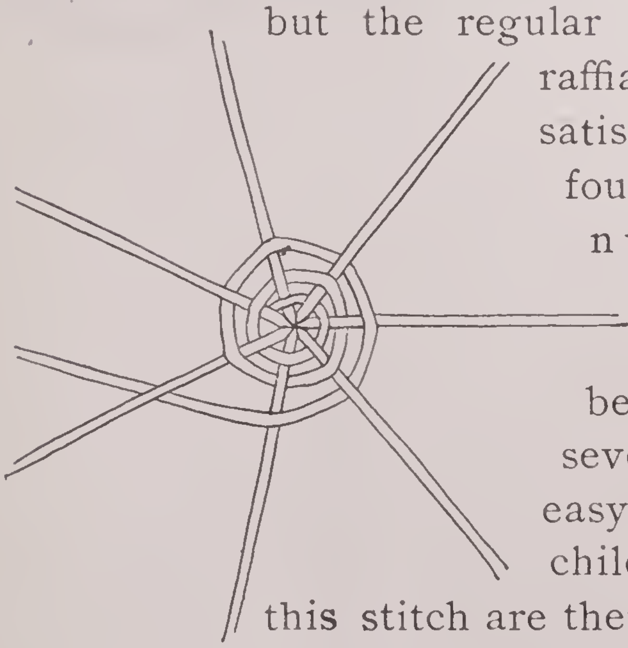


Basket-weaving has been found valuable. For this purpose the raffia fiber, for sale at florist's shops, is usually used. The foundation of the basket is made of soft copper wire or rattan. Seven pieces of either material about three inches long are fastened together in the center by a few strands of raffia. The mother or teacher will need to make this beginning, when the weaving

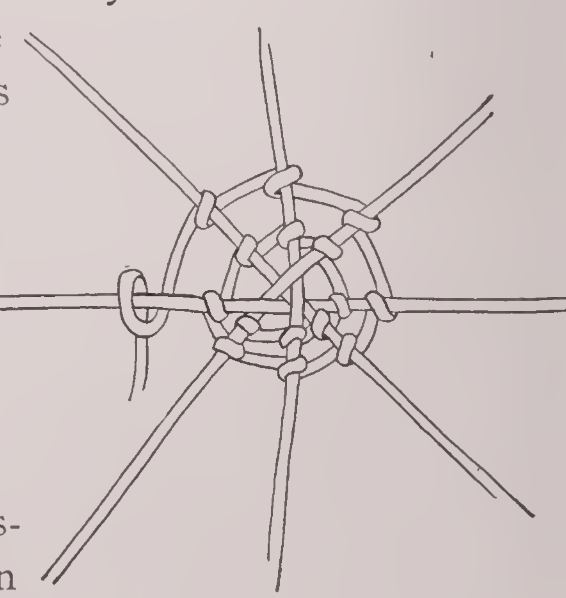




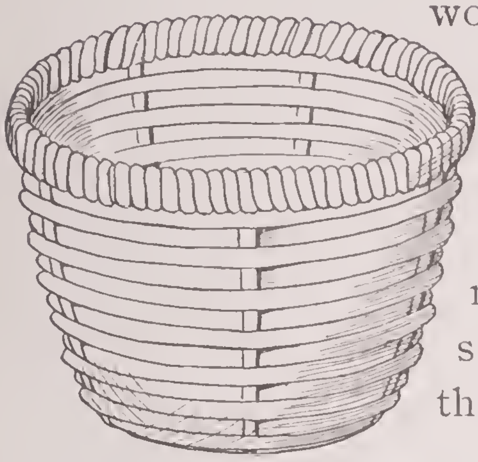
is to be done by very little children. The raffia is then woven in and out between the sticks or wires until the bottom of the basket is formed; the wires are next bent up so as to make the skeleton of the sides of the basket, and the weaving is continued. The simple weaving in and out is easier at first, but the regular weaving stitch, in which the



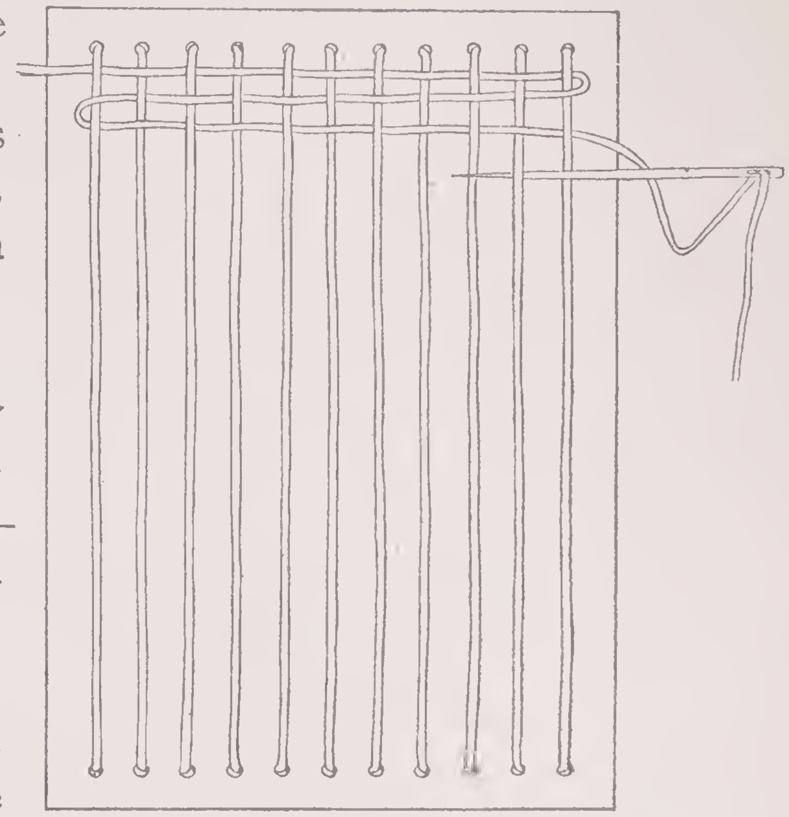
raffia is wrapped once around each wire is much more satisfactory in the end. Moreover, with this stitch, the foundation of wire or rattan may be made of an even number of pieces; the other method compels the use of an odd number; it is difficult to fasten seven pieces together, but easy to fasten six. The children who have learned this stitch are therefore much sooner able to make their own beginnings and to do all the work themselves. All sorts of baskets may be made in this way, and even complete little sets of furniture will be found within the child's power of execution.



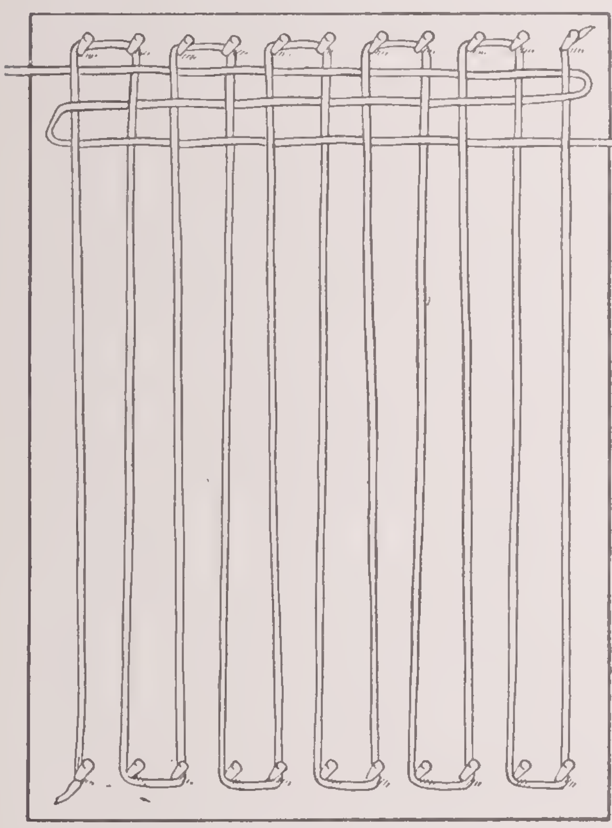
Cardboard looms for cloth-weaving may be devised by making a row of perforations a half-inch from each end of a strong card. Heavy worsted, or baby ribbon, is then strung through

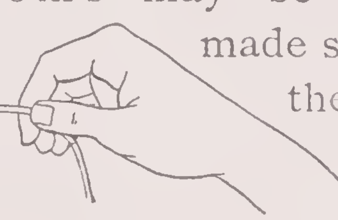


these holes in parallel lines, to form the warp A large tape-needle may be used for a shuttle, and by its means ribbon of a harmonious shade can be woven through the warp.

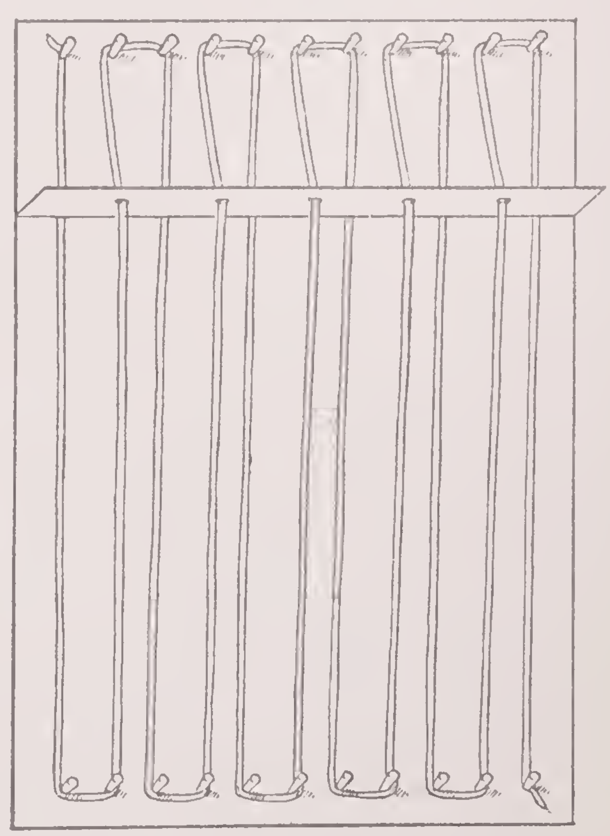


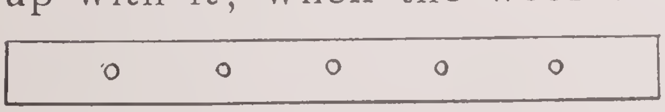
Larger looms of wood, may be made by the older children. They consist simply of a piece of board of any convenient length,—usually about twelve inches,—across each end of which is a row of large-headed nails, or preferably, wooden pegs. These pegs, like the holes in the cardboard loom, should be of an uneven number. The looms may be





made still more elaborate, and the weaving correspondingly simpler, by the addition of a primitive heddle or harness. This is a device for lifting the alternate threads or strips of the warp, thus facilitating the passage of the needle or shuttle carrying the wool. It may be made of a strip of pasteboard, as long as the width of the loom, and about two inches wide. It should contain half as many holes as the loom has pegs. Through these holes every alternate thread forming the warp is passed. When the woof thread is to be put under these alternate threads, the heddle is raised, drawing the threads up with it; when the woof thread is to be put over





the strips, the heddle is laid flat. In weaving with strips, the mesh may be pressed close by means of the fingers, but thread or worsted needs to be pressed closer A common comb will serve this purpose.

In these simple processes are all the essentials of the most elaborate weaving. As the children grow expert, they will notice more and more the texture of the clothes they wear, of the carpets on the floor, of baskets, of everything woven. They may then want to undertake the building of a large hand-loom, like the one shown in the cut. In some schools the boys of the seventh and eighth grades have made these looms and presented them to the school, where they formed part of the permanent equipment. Even if their interest never reaches so great a height, however, children should be taken to visit a cloth mill, and be encouraged to find in the midst of the whirling machinery, the spinning spools, the flashing shuttles, and the clashing heddles, the orderly outgrowth of their own familiar activity.

## SEVENTH OCCUPATION: PAPER-FOLDING

> "So much does the dominion of man over inferior animals, crude materials, and natural forces, depend upon the hand that, were it possible to deprive the human race of this important member, and put in its stead a mere paw or hoof, it might well be asserted that man would soon find a common level with the beasts, notwithstanding his superior knowledge."

How often have we seen in church or concert-hall a mother,— who has either had to take her restless little one to the meeting with her, or stay at home herself,— folding her handkerchief into the ever-delightful "rabbit" or "baby in the hammock." We all know it, have done it, or had it done for us. Or perhaps on a boat excursion, owing to the power of suggestion, a magic fleet of big boats and little, concocted out of discarded newspapers, has helped to while away the time, of not only the little people, but big ones as well. The mother's instinct tells her that these simple playthings will satisfy for the time being; and while her fingers, through long experience, work automatically, her mind is free to attend to other things. How about the child's mind?

His mind and heart are filled with wonder at the great possibilities of a common piece of paper. Perhaps he is getting his first lesson in law or evolution when he sees a simple square of paper transformed into a "book," out of which he may sing or read one of his nursery rhymes, by merely doubling it together (Fig. 1); or, if the paper is plain, in which he may draw. By opening the book and folding top to bottom and opening it again, he has a "window" with four panes in it (Fig. 2); again, by folding the two opposite sides to the center line, creasing it well, and standing it up as in Figure 3, he has a dining table; and so he is led on through many other folds, new forms

appearing out of the old, until he exclaims, as did one little boy: "Isn't it funny, the way one thing busts into something else?"

The child's needs are transient. He has to have something so plastic at this early stage of development, that he can easily modify it, such as clay, paints, etc.; but, just because of his limited knowledge and skill, he also needs some guidance along definite lines, in order to make any progress. Because of the limitations imposed by the boundary lines of a sheet of paper, his energy has to exert itself within limits suggested by the material itself, and whatever the results may be, they are all products of his own energy. In the too early use of wood-work on the other hand, in the attempt to make permanent playthings, the child's part too frequently consists in merely helping to drive a nail and adding a coat of paint.

This occupation should be used, like the others, in moderation, making the most of it when it is used, and keeping in mind its whole educational value, a value which may be thus summarized:—

1. To please and satisfy.
2. To utilize physical energy.
3. To work out thoughts, thus clarifying ideas of form, number, position, etc.
4. To give exercise in right doing, leading to accurate thinking.
5. To engender respect for hand-work, by understanding its difficulties.

In giving him these lessons we must, however, bear in mind certain precautions. One has been referred to before, the fact that since the large muscles of the hand and arm develop first, and the fine ones later, we must avoid using the finger tips. Therefore, as large paper as the child can manage and as will suit the purpose must be provided. It should never be smaller than 5 x 5 inches, and if possible 8 x 8 or 10 x 10. For the same reason, the pressing or creasing that is necessary should be done with the hand.

In the degree of accuracy required of the child when measuring and folding, much discrimination and tact are necessary, that no physical injury may result, by straining to meet the teacher's ideal of accuracy. On the other hand, if the child is not held to his best (not the teacher's best) he is acquiring a loose, slipshod way of doing things, which begets a loose habit of mind. The importance of this is aptly illustrated in the old saying:—

> "Sow an act, and you reap a habit;
> Sow a habit, and you reap a character;
> Sow a character, and you reap a destiny."

If the child wants the result, he will be careful of the means of getting it. Some one says: "The lack of thought on the child's part

is the result of lack of experience of results." Here comes in the will-training. Desire is the basis of will, and this results from memory of previous experiences. Is not this kind of will-training worth while?

Keeping well in mind, then, the stage of the child's physical development; the moral question that arises in the degree of accuracy required; and the interest which is necessary to any healthful work or play, we are ready to begin.

The steps in folding, with the four or five-year-old child, are at first so simple that he is easily and happily led to the making of very satisfactory temporary playthings, such as furniture for paper doll houses, caps of various kinds, baskets, and other suitable articles.

When the child makes for a definite object, his model should be good, that is, as good as the material will permit. If the object is to be a doll's bed, due consideration should be given to proportion. To make it, fold a 6 x 8 oblong of Japanese manila paper in half, both vertically and horizontally, or in half both ways, open and fold two short edges to center line, open again and fold two long edges to center line. Cut on dark lines, and place in a vertical position; lift paper, and bend lines to form side boards for bed to rest upon; bend little oblongs forward by the cuts for head and foot of bed to rest upon, then paste and reinforce both head and foot with pieces of paper 3 x 3 and 3 x 3½; bend the upper edge of the foot-board over the 3 x 3 piece; then paste again.

In the accompanying sequences, we can readily see wherein the child has had to utilize to the utmost his limited store of knowledge of form, number, position, and to work this knowledge over, correct, and add to it; and when the end is attained, the feeling of satisfaction over work well done is sure to give a healthful mood, and he is ready to receive his just due of approval.

The child is seated at a low table with a perfect square of smooth, uncreased paper in front of him. Let him point out the front edge, the back edge, the left and right edges, and the center. Then proceed to show him how to fold the following forms, being careful not to give him too many at once. As long as he is contented and interested with one form, let him play with it; when his interest begins to flag, give him another.

1. Fold the edges of a square of paper together and crease. (See Fig. 1, the book.)

2. Open "book" and fold top to bottom, crease, then open, and we have the window. (Fig. 2.)

3. Fold side edges of window to center line to get the closed blinds. (Fig. 3.)

4. Lay paper with blinds down on table and fold top and bottom of window to center line. This when made to stand up is the small square table. (Fig. 4.)

Fig. 1

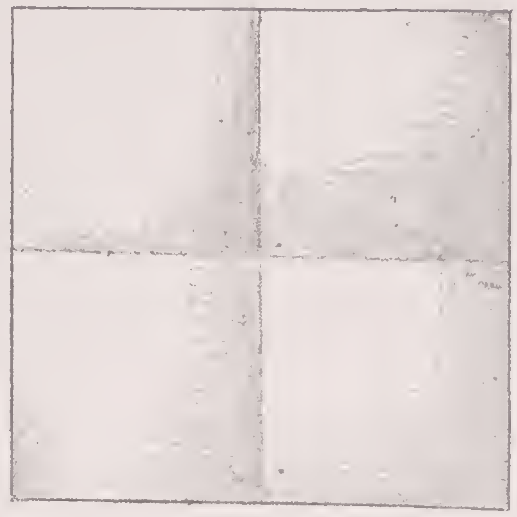


Fig. 2

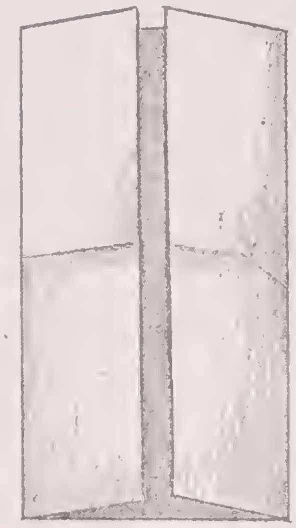


Fig. 3

5. Close and turn the table so that the four small squares are on top.

Place finger under one of the squares and lift it out sidewise until a triangle is formed, then crease.

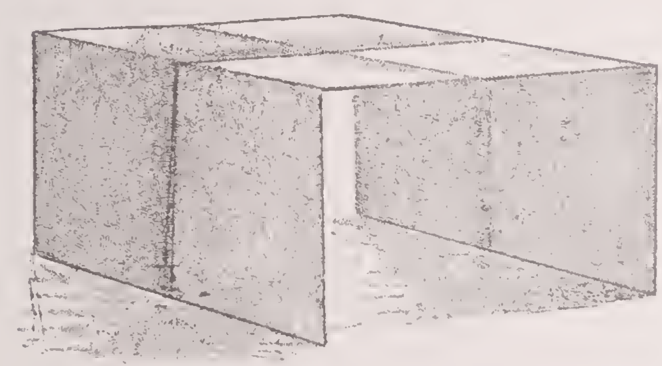


Fig. 4

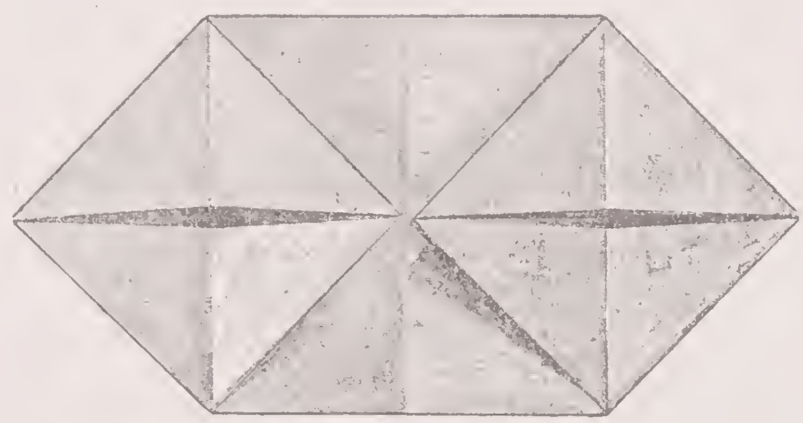


Fig. 5

Turn the three other squares out in the same way.

Fold top to bottom, crease well and we have the double rowboat. (Figs. 5 and 6.)

If desirable to go slowly, each article may be played with, in the manner suggested by each successive step. It might be well to give only one or two forms at one sitting. The idea is to let the child go as fast as he can without needless expenditure of energy or interest.

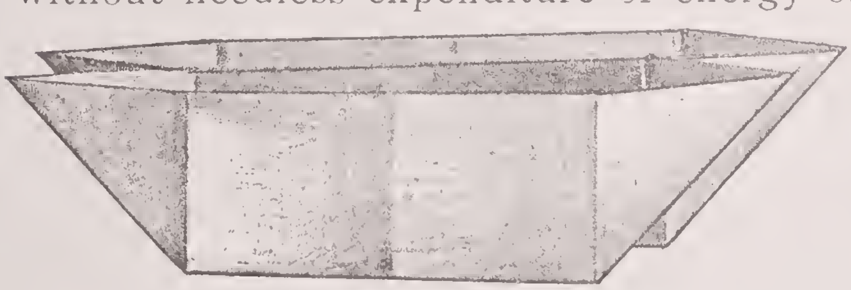


Fig. 6

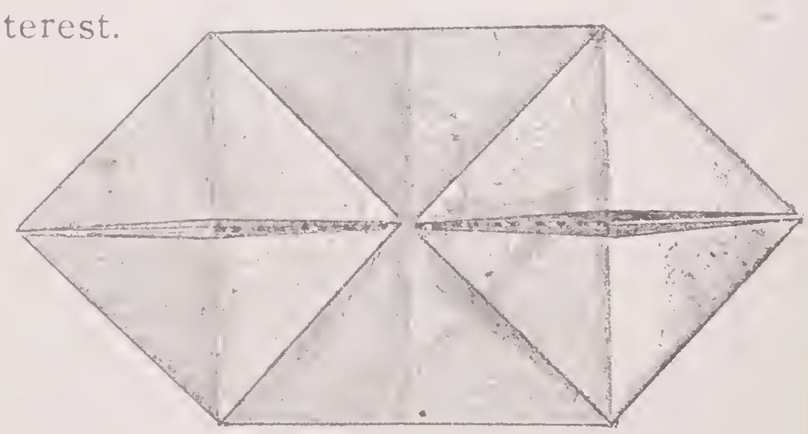


Fig. 7

A Trough

(*A Memory Test*)

Fold a book.

Fold a window.

Close the blinds.

Fold the table and turn squares into triangles as we did for the boat. (Fig. 7.) Cut on dotted lines and put the two triangles thus made one

inside the other, thus forming ends for trough. The remaining triangles at each end serve for legs.

This, lined with tea-lead, filled with water, and placed outside the window, may serve for a birds' drinking dish. (Fig. 8.)

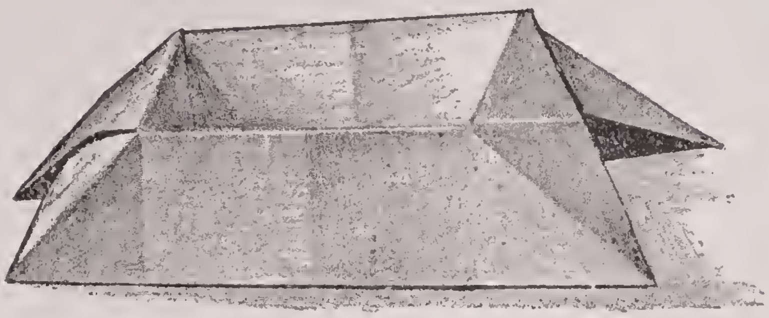


Fig. 8

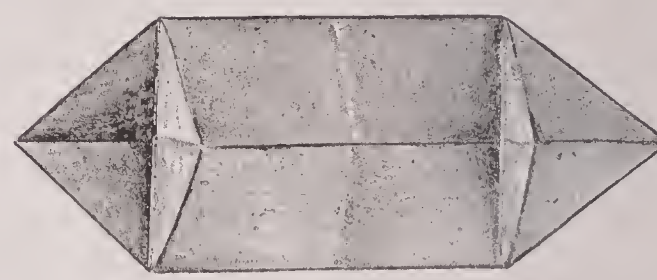


Fig. 9

### Corner Bracket

Fold as for trough.

Hold open edges of paper toward you; fit one sharp corner into the one nearest to it, and a corner shelf is formed.

Do the same with the two other sharp corners, paste, and the double corner bracket is ready for use. (Fig. 9.)

### Comb-case

Fold a 10 x 10 sheet of Japanese manila into a window.

Fold four corners to center.

Fold one of the new corners to center.

Paste this last fold upon the two folded corners upon which it rests, and the comb-case is ready for use. (Fig. 10.)

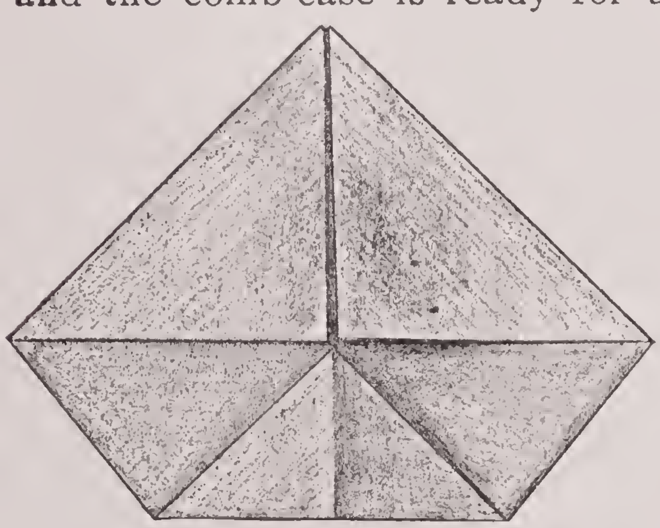


Fig. 10

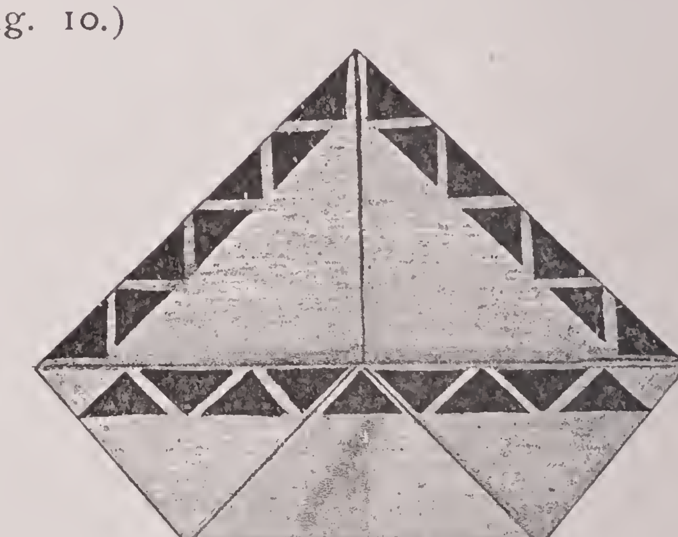


Fig. 11

If you wish, a border of colored-paper, triangles may be pasted on and the present for some one is done. (Fig. 11.)

A border of circles requires less delicacy in pasting and handling than one of triangles, and may therefore be found useful for the younger or less skilful, children.

### Sail-boat

Fold the window, then fold the four corners to the center.

Turn the paper over and fold the four corners on this side to center and crease well. Undo all of the folds and we have a table-cloth for a

square table. (Fig. 12.) Turn the table-cloth over and hold down the four triangles that fit the center of the cloth, then crease the standing-up corners from corner of cloth to corner of center square or table-top.

Hold paper with corner toward you and fold together two opposite corners of center square or table-top.

Push the two large triangles on those same corners together, and here is the sail-boat. The last triangles may be pinned or pasted together if desired. (Fig. 13.)

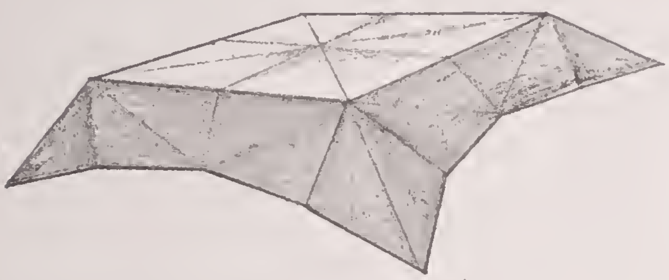


Fig. 12

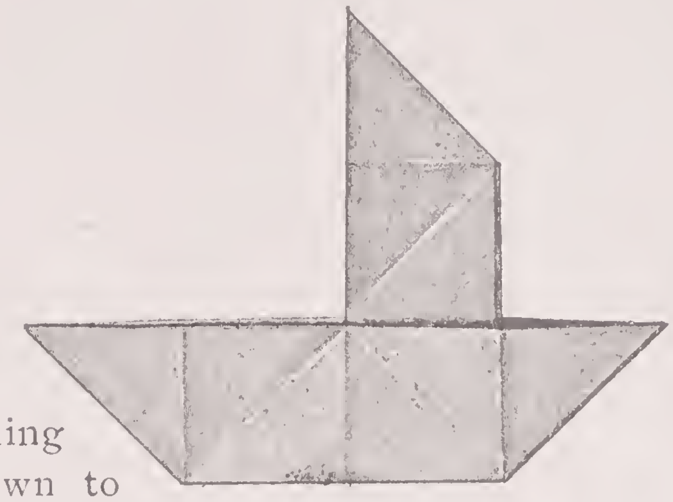


Fig. 13

By folding the table-cloth form, turning it over and pressing the four corners down to form four squares on top, we have a form (third fundamental) from which quite a number of satisfactory decorative forms may be made.

With third fundamental, cornerwise on table before you, fold the right and left corners of the front and back squares, underneath: fold the two other squares to look the same way. A number of these in a row may be used as a frieze. (Fig. 14.)

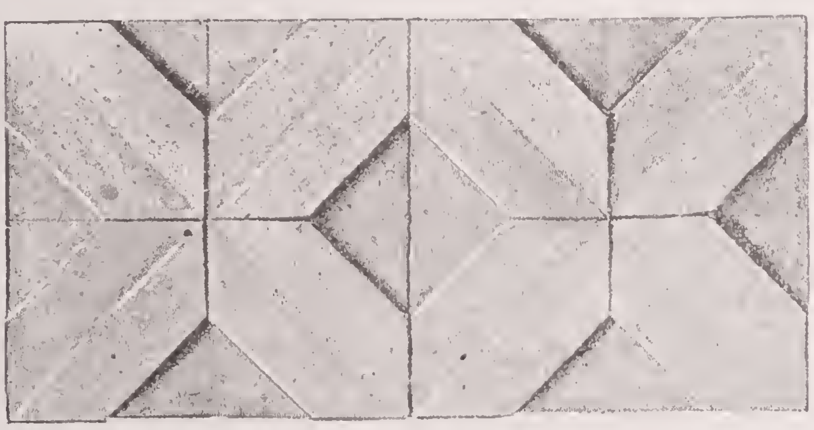


Fig. 14

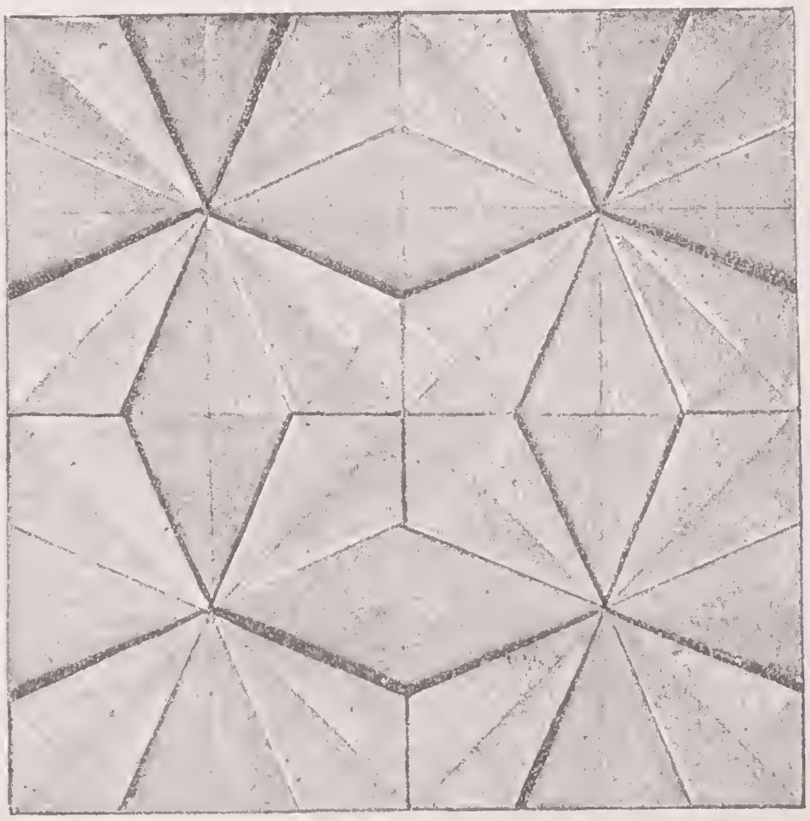


Fig. 15

By folding these squares on top into kite form, or diamond form, four papers folded or placed around a common center make a quite pretty rosette form, which might be used to decorate the top of a box. (Fig. 15.)

## Some Pieces of Furniture

In order that the child may work thoughtfully, he must have a clear mental picture of his bed, or lounge, or whatever he is to make. If, for example, he has not a finished model before him, his varied experience of lounges would interfere with his making one that the material supplied

would suit. He has been given time to experiment, but now he is limited to his material.

The bed has been described. (Fig. 16.) The lounge to go with the bed is to be folded from oblong 4 x 8.

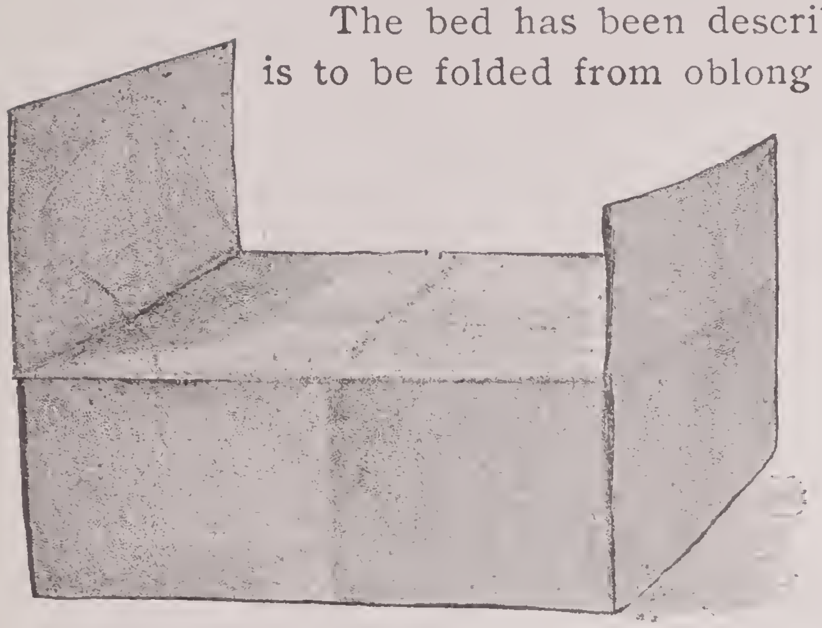


Fig. 16

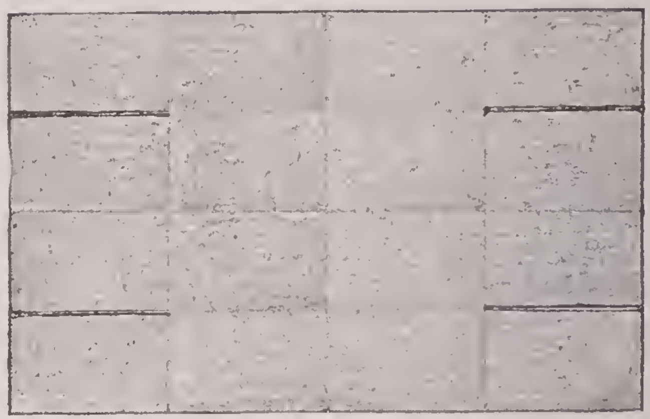


Fig. 17

Fold the oblong into half.

Fold the oblong into half the other way.

Fold each half in two again, forming eighths.

Fold each eighth in half so as to give sixteen small oblongs; cut in dark lines (Fig. 17) and paste together the two little oblongs on each end.

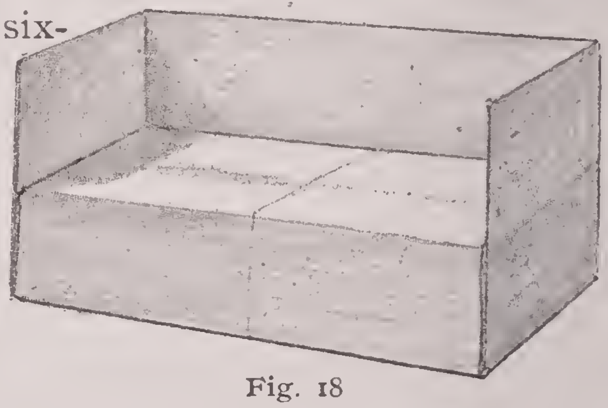


Fig. 18

Fold and paste the overhanging squares over and under these end-oblongs to make it strong, and the box seat for the « davenport » is done.

Paste on a 2 x 8 piece for back and arms. (Fig. 18.)

## A Chair

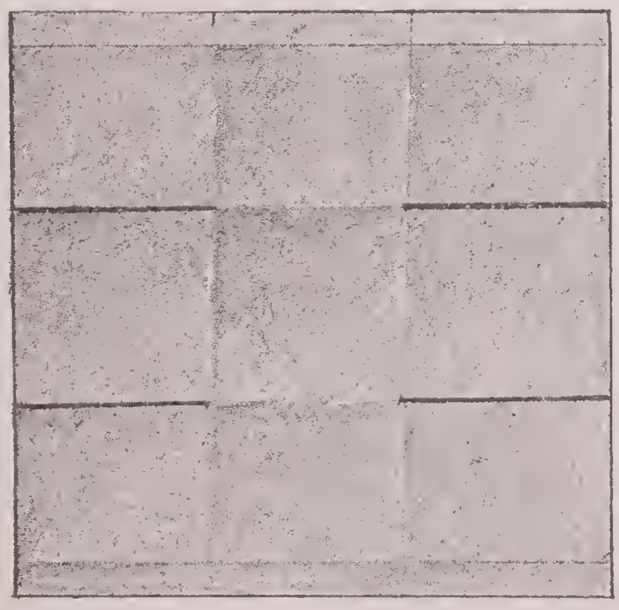


Fig. 19

Fold a 5 x 5 paper into three equal parts.

Fold into three equal parts in opposite direction.

Cut in dark lines. (Fig. 19.)

Fold over about one quarter of the three joined squares on two sides.

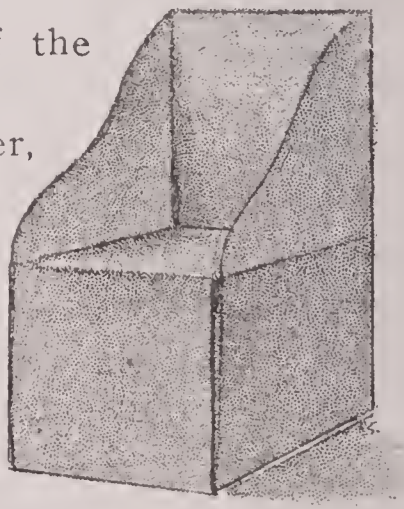


Fig. 20

Bend these folded edges under, overlap, and paste the squares at front and back and fold one of the loose squares under, to fit, for front of chair. The remaining square serves for back.

To make an easy chair, add an extra piece 5 x 3 for back and arms of chair. Curve the arms to suit taste. (Fig. 20.)

## EIGHTH OCCUPATION: PAPER-CUTTING, PAPER-MOUNTING, AND SILHOUETTING

The child early shows a fondness for the use of that curious tool, the scissors. This is not surprising. He sees his mother cutting so deftly, absorbed in her own work; he sees the interesting results. It would be strange if the child did not try to imitate this. If he is able to use the scissors only by stealth, he will probably use them to damage curtains, clothing, or bedding. When the mother permits him to cut only shapeless bits of paper and cloth, she loses an opportunity for training the child. He intuitively recognizes that this is mere destruction, and not creative work, and it fails to satisfy his nature. The purpose of the eighth occupation is to make use of this instinct for cutting. Unless the parent directs the activity of the child, the latter will misdirect it for himself.

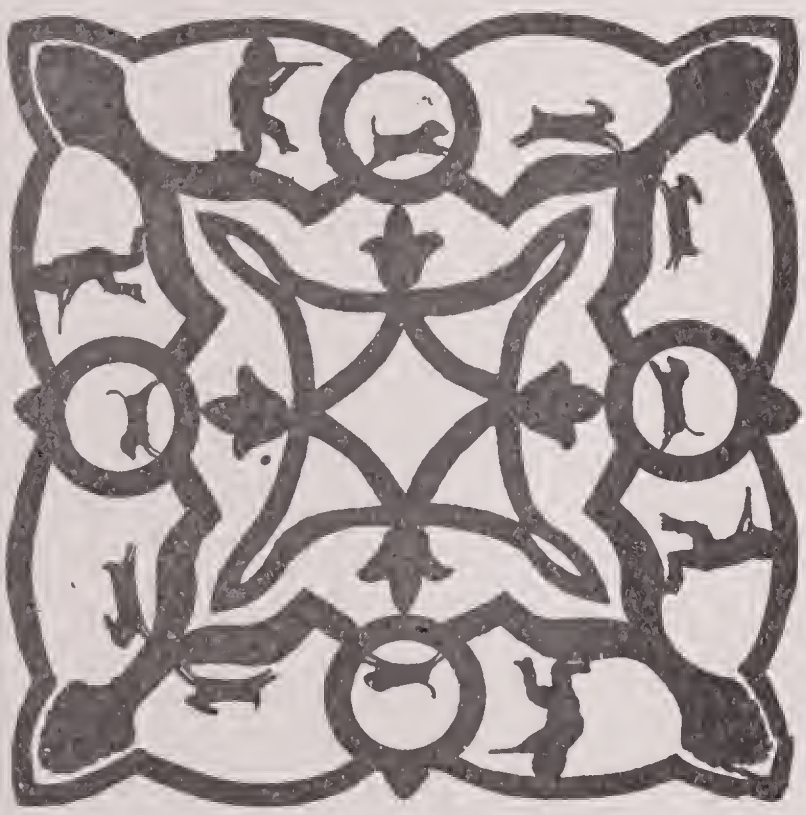
Some of the comments made upon drawing are equally true of cutting, for cutting is a kind of drawing. Correctness in folding and precision in cutting lay the foundation of habits of accuracy which are valuable through life. The eye is trained, the muscles of the fingers and the hands are trained, to obey the orders of the will. In cutting and mounting, the two opposites, analysis and synthesis, are combined. The act of cutting divides or analyzes the plain surface that is cut. The subsequent restoration of the parts to form a new unity is a synthetic process. In this occupation, the bits, even the smallest ones, are not thrown away, but they are saved up to be mounted on a cardboard.

Before the cutting begins, the child should be interested in his tools. Every child has looked with wonder on the scissors-grinder, and listened to the ringing of his automatic bells. The grinding wheel that throws out sparks from the steel is alluring to the infant mind, and the man who apparently comes from nowhere, and goes on again into nowhere, but leaves behind him the boon of sharpened scissors, is a good starting point for a lesson to the pupil upon this subject. It is interesting for the child to know the large variety of instruments that may be classed under the general name, scissors. There are button-hole scissors, manicure scissors, and a number of straight scissors, in sizes from the tiny embroidery scissors up to the large shears. Above these are the tailor's shears, and those used by the plumber for cutting tin or sheet iron.

Mucilage is used in mounting; and the child should be told of the country of Arabia, where the tree grows from which the gum is

taken; the Arabs who gather it, the camels who act as freight cars for transporting it across the desert, and other pertinent matters.

The various stages of paper-cutting are fairly represented by the statement of the following grades. First comes cutting off. In this the paper is folded, and the pupil cuts off a piece, following a line of the simple fold. Secondly, there is the exercise of cutting out. In this stage the pupil cuts into the paper along given lines and takes pieces out of it. The third stage is called free cutting. This is a variation of cutting out, but the determining principle of it is that the pupil does not follow creases or other given lines, but cuts according to his own design or fancy. These permit more latitude to the invention of the worker than the other forms allow, and the designs are sometimes of great beauty or oddity. The illustrations below, not remarkably difficult, are of varieties of the eightfold ground-form cutting, to which the pupil comes by easy stages. The designs, when suitably cut out, will be preserved by mounting them neatly upon cardboard. This part of the work does not give play to inventiveness, but it requires much care and patience.



Silhouetting follows free cutting. The silhouette is an outline portrait, or profile, in black. It was first made by projecting a shadow from a candle upon a piece of white paper. In imitation of this shadow, the silhouettes were outline figures cut out of black paper and pasted on a white background. In every nursery, the children are amused by fantastic shadows cast from the hands upon the wall. These give the idea of the silhouette.

Black glazed paper is used for kindergarten silhouetting. The forms, beginning with the simple and proceeding to the difficult, are cut from this paper and duly mounted. Another kind of shadow picture is made by cutting out portions from a piece of paper in such a way that, when held between the light and a white wall, the open spaces form the lights and the remaining paper forms the shadows of the picture. This gives something of the effect of a crayon drawing, and may be the source of much entertainment.

## NINTH OCCUPATION: PEA-WORK

THE materials used for the ninth occupation are marrowfat peas and long slender sticks. Corks or balls of clay are sometimes substituted for the peas, and wires are sometimes substituted for the sticks, but the materials named are, all things considered, the most satisfactory and the easiest to obtain. The peas should be soaked for twelve or more hours in water, and dried a little after being taken out. In this condition they are soft enough for the purpose and will receive the sticks without splitting. It is hardly necessary to say that they should be as nearly uniform as possible.

The sticks should be about a foot long and quite thin. They will then be easily broken into desired lengths by the pupil, and they will readily pierce the pea. They should be stuck into the cheek of the pea, not into the eye or the crease, as the latter may cause splitting. After the pea has dried, it holds the stick fast so that the work is, comparatively speaking, permanent; at least, it is strong enough for the pupil to carry home from the kindergarten school, and, if not unreasonably disturbed, it will last a long time. Wires have the advantage of sticks in that they are thinner and stronger. On the other hand, they cannot be broken into desired lengths, and common wires are liable to rust.

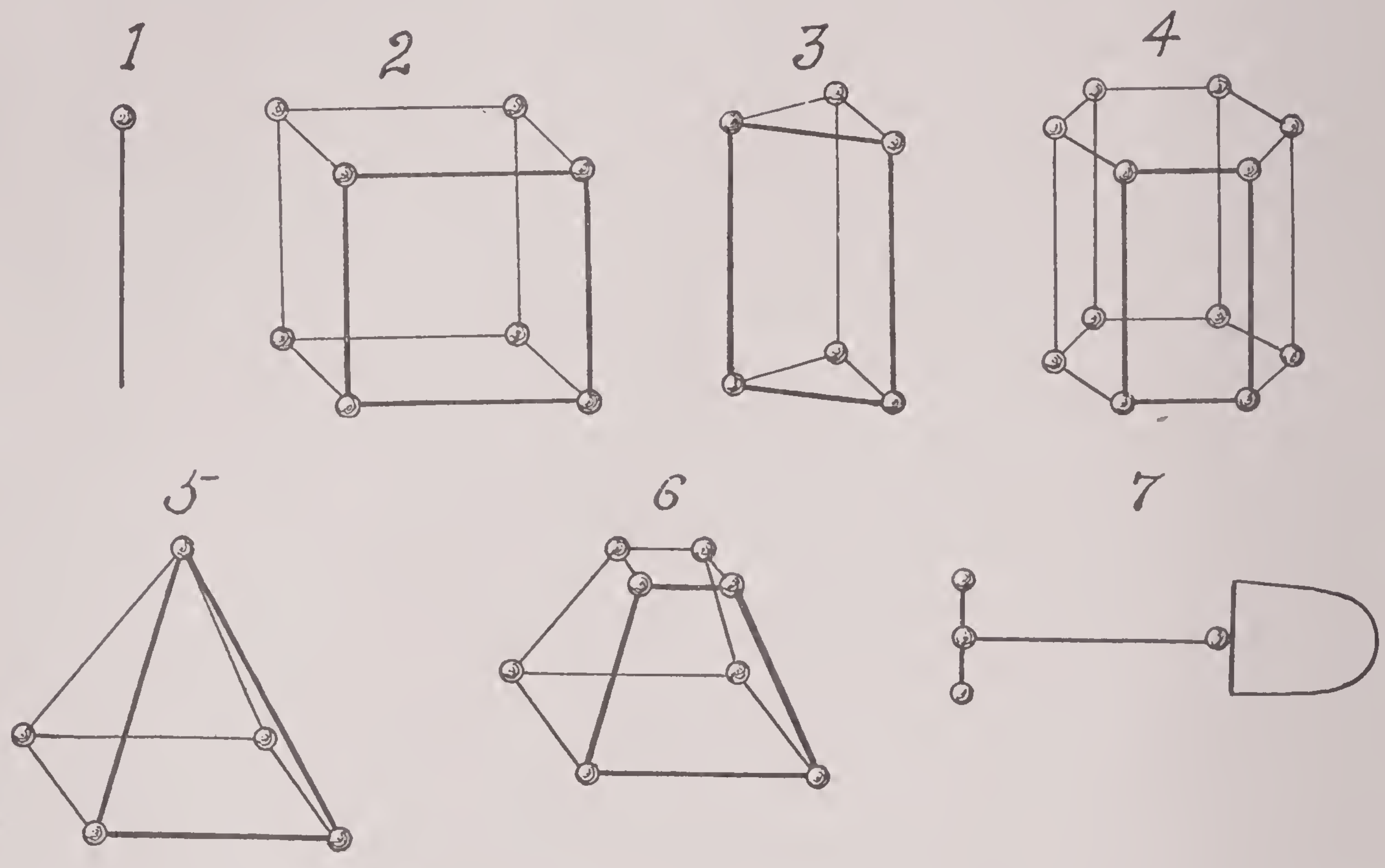
The simplest exercise in this occupation is pushing the end of a stick into the cheek of a pea. This makes a cane, a drumstick, a shawl pin, or whatever else strikes the fancy of the child.

When the other end of the stick is thrust into the cheek of the second pea, the result is a dumb-bell. If a second stick be pushed into the pea at right angles with the first, there is a square corner. By means of four peas and four sticks a perfect square is completed. In a similar manner a triangle may be constructed, and figures of five, six, or any other number of sides.

Take two squares and, with the addition of four sticks of equal length, it is easy to make the outline of a cube. This will be helpful to the child, for, by enabling him to see through the solid, so to speak, it will surely give him additional understanding of the cube. In the same way, prisms may be constructed from triangles, pentagons, and other plane figures.

It is not necessary to give additional instruction as to the method of forming an outline pyramid or the frustum of a pyramid, as these will readily occur to the teacher, or even to the pupil himself. The illustration makes them fully plain.

Circular figures, or circular parts of figures, may be made by substituting wires for sticks, and plane surfaces may be represented by the use of silvered paper. A variety of objects may thus be constructed.




Many ornaments may be made of pea-work, but its real value consists in this, that it enables the pupil to see into things, not to see the outer surface only. The study of geometry is no part of kindergarten work, but the child who, from training in pea-work, has had the benefit of this seeing into things, will, in later years, have an inestimable advantage when he takes up that branch of mathematics. It will give him a firmness of grasp upon the subject which too many students of geometry lack.

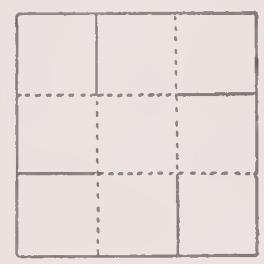
## TENTH OCCUPATION: CARDBOARD-MODELING

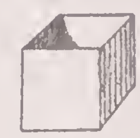
This occupation represents hollow surface-bodies. It is the link between the plain and the solid. Both open and closed forms are made, and the latter, since they inclose space, are allied to solid bodies. In paper-cutting, the paper is first folded and then cut; in cardboard-modeling, the cardboard is first cut and then folded. In pea-work, the attention is directed chiefly to the corners and edges; in cardboard-modeling, the attention is, in a subordinate way, directed to edges and corners, but the surfaces receive the chief consideration.

The materials for the tenth occupation are cardboard, or stiff paper, mucilage, and cutting tools. Knives and similar cutting tools are

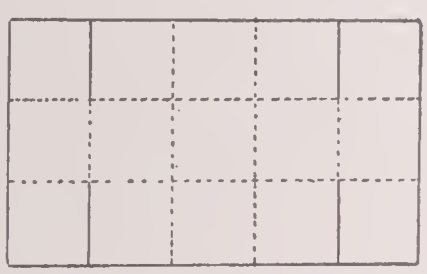
dangerous for young children, and for this reason the only tool used in this occupation is a pair of scissors, with rounded ends in place of points. If cardboard is used it should be pliable, and not too heavy. The paper or cardboard should be covered with a network of lines at right angles. For beginners the spaces in this network should be about a half inch, but the size may be varied according to need. Cardboard, like paper, will stretch when moistened by mucilage, and so great care is demanded to fit edges and corners to a nicety.

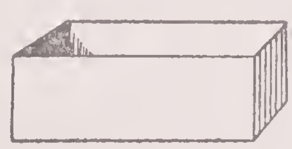
The first lesson of the tenth occupation will be to make a box. Children are generally interested in boxes. They convey many suggestions to the infant mind. Candies and various sweets dear to the child's palate, come from the store in fancy boxes. Among the boy's possessions will be found boxes of marbles, stones, nails, strings, fish-hooks, and other articles highly prized. The mother has an assortment of boxes containing buttons, ribbons, bits of silk, pictures, and innumerable other treasures. It will not be hard to interest any child in the making of a box for his personal use.





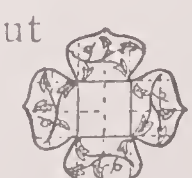
Give the child a piece of paper, on each side of which there are three squares of network. Then let him cut along the line of the lower righthand square, cutting one space from the bottom upward. Turn the square piece of paper one quarter way around, until the left side becomes the bottom, then cut again precisely as before. Turn once again in the same way and repeat the cutting, and repeat this process a fourth time. There are then four slits in the paper, one at each corner. Then crease the squares along the marked lines, turn up the sides, fold over the ends, secure them by a little mucilage, and the box is complete.





Oblong boxes may be made in the same way, using oblong paper instead of square. This simple box illustrates the entire principle of the tenth occupation. The forms may be varied so as to make prisms, pyramids, octahedrons, cones, cylinders, and other figures. More ornamental and still more interesting to the pupil will be the simpler forms of trays and baskets.

It is desirable always to encourage the pupil to design original forms. This will be a valuable preparation for future work. But in this they need supervision, in order that they may not depart from the principles which underlie kindergarten work. The work of the tenth occupation will result in many beautiful and useful articles, thus giving pleasure and developing the sense of beauty, but it will also train the worker to concentration of thought.

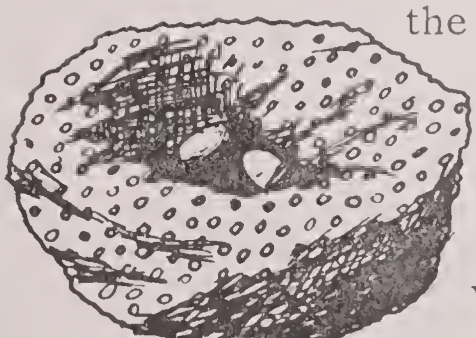


## ELEVENTH OCCUPATION: MODELING IN CLAY*

In the previous work, the material had a shape of its own. In the eleventh occupation we deal with a shapeless material—clay, or wax or sand which may be substituted for clay. All children love to create shapes out of shapeless material. When they play in the sand, they are continually making stairways, wells, tunnels, houses, and such forms. Most children have had experience in modeling a snow man. They almost universally serve an apprenticeship in making mud pies, and they have done so time out of mind. This occupation purposes to use this instinct, and make it a means for the development of the child's various powers.

In kindergarten work, clay-modeling is used as a means of education, and not for the sake of its artistic value. It trains both hands to dexterity. It develops the appreciation of beauty. In an unusual degree it trains the eye to accuracy. Finally, it trains the observation and memory, for the worker must see how the object looks and carry it in his mind. If he fails in this, his attempt to reproduce it will be grotesque and hideous. The work will require much patience, and the worker must be content not to try to get on faster than his improvement will justify. The help he receives should be in the way of suggestion, and the teacher should not do his work for him.

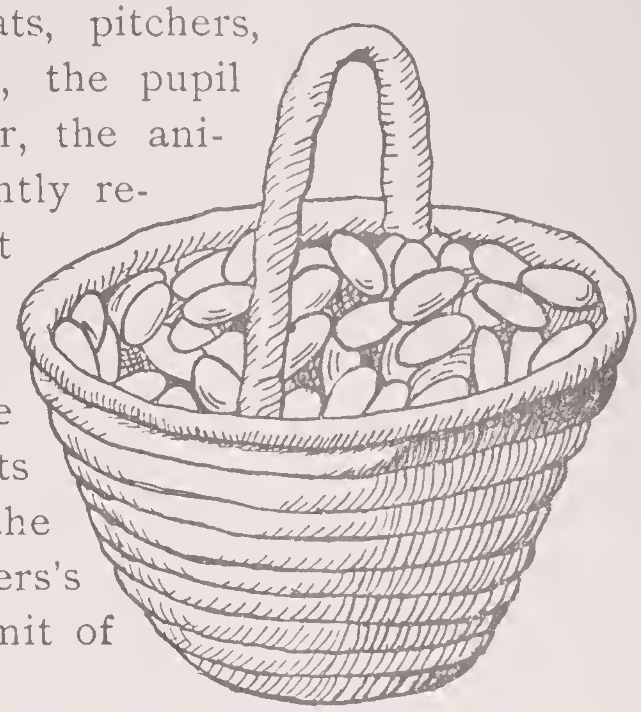
The first forms which the child will naturally make are the sphere, the cube, and the cylinder, and these bring him back to the gifts, the starting point of kindergarten work. The sphere may be slightly modified so as to make an apple, an egg, a plum, a pear, and a number of them will represent a bunch of grapes. Then let the child place the sphere in his left hand, and work into it with his right thumb, and he has what interests every child, a bird's nest. A couple of ovals are put into it and these are the bird's eggs. Then a rope-like form is rolled out between the palms of the hands and is fastened to the edges of the nest, curving over the top, and the nest becomes a basket.



The cube is made from the sphere by striking the latter upon a flat surface, such as the table, upon the six respectively opposite sides, until these sides are square and parallel or at right angles. The cylinder is made by rolling out the clay and flattening the ends. Out

*For a fuller treatment of this subject see page 3799.

of these three fundamental forms, the sphere, the cube, and the cylinder, by slight additions or variations, large numbers of subjects may be modeled. These forms will include fruits, hats, pitchers, pails, vases, trunks, bureaus. At the proper time, the pupil may go on to such life forms as the leaf, the flower, the animal, and the bird. But the teacher must constantly remember that the primary purpose of this is not sculpture, but education. It is the training of the eye and hand, and the cultivation of the mind through the eye and hand. The work is very fine and there is no limit to it. The child who starts from the rude imitation of an orange may reach the point of Thorwaldsen's "Lion of Lucerne" or Powers's "Greek Slave," and still he has not reached the limit of possible beauty.



# SEWING

WHILE many industries have drifted away from the home, sewing, in large measure, still remains. The loom, for instance, belongs now mainly to the factory, and only in isolated places, or for small special industries, such as the weaving of rag carpets, and of the more elegant silk-rag hangings, do we find the loom in a home, or a person working alone at weaving. But in spite of the factory and the shops where the great work is done by sewing machines, and in spite also of the sewing machine itself as a chief element of help in family sewing, the needle still holds its place, and the workbasket is as faithful and as significant as ever.

The teaching of sewing in schools has for its aim not merely to produce handiwork, not merely ability to advance the physical comfort of oneself and others, as every one who sews may do, but also to be a means of the expression of force in the children along the lines of trained and skilful doing. This is done in the recognition of the principles that the head and the hand belong together and that each should help the other in learning.

In the family, or in any little group of children, this principle should be remembered, and all the learning should, as far as possible, be made a joy to the child; not a task severely enforced solely for learning's sake. This ancient spirit of compulsion and drudgery should be replaced by better things.

For work beyond the kindergarten grade, where regular sewing is to be learned, a child at home enjoys having a pretty workbasket of her own. If a class is to be taught, it is more convenient for the children to use bags, and to have these large enough to hold not only the materials for work, but the article that is being made. In either case, certain things are wanted and their collection is of interest to the child. The list may be:—

I. A small pair of scissors for cutting threads and small bits of cloth.

II. A thimble, thin and well fitting; silver is best.

III. Spools of white cotton, Nos. 50–80, and one spool, No. 60, of colored thread for basting.

IV. Needles—one paper assorted, Nos. 5–10.

V. An emery cushion.

VI. A small cushion or ball for pins.

These are the essentials for beginning. As the work goes on various things will be wanted—a tape-needle for running a string of

tape or ribbon into a hem, a stiletto for eyelet holes, varieties of needles for different kinds of work, and with them varieties of thread — wool, silk, linen, and cotton — and a thin, flat rule marked by the inch and its fractions.

For materials on which to begin to practice stitches, nothing is quite so good as Java canvas, and coarse burlap. Still, these satisfy the child but a little while, and they must soon be followed by materials for making real things for definite purposes. Among these, checked gingham is helpful, as the blocks and lines are a guide to the eye in the evenness of the work. Plaid nainsook also is good material, especially for the making of aprons. Cotton with as little dressing as possible should be chosen. The soft Lonsdale is very good.

## NEEDLES

To OPEN a paper of needles is to see what an amount of work has been done in their preparation. There they stand, side by side, in regular order, polished, sharp-pointed, with fine little eyes ready for service. They have an elegant appearance and look as if they were fitted, as they are, to be great helpers in many fine and interesting ways; and as we examine them we can have no doubt that they have gone through many hands and taken many steps as they were made, first into uncut steel wire and finally into these perfect little tools.

Needles come in three lengths — sharps, ground-downs, and betweens. The middle lengths, called betweens, are good for beginners, as children are likely to hold the needle too tightly at first and the sharps are the most easily bent. Needles range in size from No. 1 to No. 12 and are suited to all kinds of sewing, from the seams of carpets to the hem-stitching of finest lawn. In a paper of assorted needles we see most of these sizes at once, the coarsest, No. 5, in the middle, the finer ones on each side, Nos. 6, 7, 8, 9, and 10. By a little use we become accustomed to these various sizes, and can tell at a touch what size is best for the work in hand.

When a needle has been selected for use, the paper should be refolded and put back in its place. This place may be by itself, or it may be in one of the many folding cases made for sets of needles. These folding cases are popular and very useful.

For darning and for worsted work, special needles are made. They are either sharp or blunt and they have a long eye. In sewing with these and other kinds of needles, keep them bright and smooth, first, by using them with clean fingers and, when necessary, by rubbing them in the emery ball. If they become bent they should be

thrown away, for to make true stitches and good lines in sewing, one must have true and well-kept tools. When the work is put away, the needle may be carefully fastened into the material ready for use at the next lesson.

To Thread a Needle.—Sit up straight, take the needle between the thumb and forefinger of either hand, hold it so that you can see the eye easily and put the thread through it. In doing this, each may take her own easiest way, using one hand or the other, or sometimes one and sometimes the other. Very few people do this in just the same way, and trying a thing in several ways makes many children quicker and more skilful than following a single rule.

To Thread the Long-Eyed Worsted Needle.—Take the worsted between the left thumb and forefinger about an inch from the end. Lay the point of the needle across the worsted as it lies on the forefinger; with the left thumb draw the end of the worsted down tight over the needle, draw the needle out and thread it with the loop that you have made.

In breaking the thread from the spool, take off about the length of the arm. The end must be twisted between the thumb and finger, to make a fine point that will enter the eye of the needle. When this simple connection has been made, the child has in hand a long line, flexible and yielding at every point, but terminated by the straight, inflexible, unyielding cylindrical form—the needle. The child works with the point, from point to point, leaving behind him a line of construction; he works to its definite conclusion, and usually he works to produce something that has relation to life, that can be used, or worn; or he works to decorate something, a mat, or a table-cover, with color and design.

In elementary sewing, boys are often happy to learn how to do the first simple things with a needle, and there are always men who use the needle in regular industries—as tailors, harness-makers, shoemakers, and sailmakers. This is not home sewing, however. It belongs to shops and is done in preparation for business, for buying and selling the things that are made. The sewing that is simply for personal comfort and for the family good and pleasure, is done at home, and in that sort of hand-work, people have for generations been taking the stitches that each child has now to learn, and for which the needle is threaded.

## KNOTS

To MAKE a knot — first thread the needle. Take one end of the thread between the thumb and forefinger of either hand, just as may be most natural to you, pass the thread about the tip of your forefinger to make a circle, and press tight against the thumb, holding the thread tight with the other hand; then slip the forefinger out of the loop of thread and, with the end of the next finger and thumb, draw the twist downward into a little, hard knot. In a few days this will become a habit.

The knot for sewing is one of the simplest knots in the world, but it serves a great purpose. In sewing it marks the beginning of the work, and the beginning of every new thread that is to be used along every new line that we are to produce. As we make these tiny knots, we may think, by way of contrast with them, of the knots that are being made elsewhere, by other hands, for other purposes, though these be but the continuation of our purpose, the perfecting of our life-work. There are the knots that are tied about packages that are to be sent out on journeys — hard knots, simply tied with string that is to be used but once; cut open and thrown aside at its journey's end. Then there is the great work where, as at sea, the heaviest ropes are used, and when the greatest care is taken that they shall never be cut or injured in any way because so much depends upon them. The ways in which these ropes are woven tell their own story.

Our thread for sewing is usually made of three light strands loosely twisted together. For fine work, we split our silk and use each strand separately. But the ship's cables, the great ropes that are made to bear the severest strain, are of thick strands, woven together three times three, in order that they may hold against the blowing of the wind and the beating of the water. With all these ropes that belong to great industries, men have, by practice, acquired great skill in tying knots of various kinds. Tying the ropes quickly and well is a great part of a sailor's training; and each knot has its name and its own particular use. We hear of the bowline knot, the square knot, two half-hitches, the wall-knot, the crown; and there are many others, some for one use, some for another.

The little sewing knot also has its place with a host of greater ones, and every one who sews must make it well and often. It is not necessary, however, to begin all sewing with a knot. We can often take a few stitches and then tuck in the loose end of the thread under the folded-over edges of the material. That is a very little

thing, but all hand sewing is done stitch by stitch, and as the sewing-machines now do so much for us, and we do by hand only the very nicest work, it is well to learn all that helps to make the sewing beautiful.

## THE STITCHES

The stitches that we take in sewing are all straight lines, set in different positions. They are horizontal, vertical, and slanting. The work that is done with them in different ways is mostly known as basting, running, gathering, hemming, stitching, backstitching, overcasting, overhanding, the sewing of edges with the blanket-stitch, the well-known buttonhole-stitch, and darning.

In learning to sew, the horizontal lines come first. These are most easily made and are often used when work is begun in the simple lines of basting — running a thread to hold two edges of cloth together while they are being sewed. The stitches may be learned by practice on a sampler, that is, a piece of canvas on which all kinds of stitches can be worked in rows, one after another. This is interesting to make, and useful to look at if one forgets just how a stitch has to be taken. To make a sampler, take an oblong of Java canvas, nine inches by six; or a square of eight inches. An inch or more below the top choose a line for the first row of sample stitches. The first of these should be for basting.

To Baste. — In ordinary basting, the stitches should be short on the under side, and long on the upper. To mark this on the canvas, one thread can be taken up, and three or four of the threads can be passed over to make the long stitch on the outside. In basting gingham or any of the light materials that children use, No. 50 cotton and a No. 8 needle are suitable. The thread must not be too long, as it will kink or break; it also hinders in the sewing because it takes too much time, and too much attention and movement on the part of the sewer to draw the length through the cloth.

To baste a hem or a single seam the stitches may be uneven — that is, half an inch long on the outside; but for strong and careful work like the waist of a dress, the baste is made with very short stitches even in length on both sides. Also, when work is heavy the baste may hold better if we begin with a couple of short, even stitches, with a long one following.

For practice in basting, the child should first see the process as a whole. This is the correct principle, indeed, in teaching any stitch. First, show the child some finished work so as to give an idea of the use of the stitch, its general effect and appearance, the slant and

nearness of the threads, and the neatness with which the work has been done. This will satisfy the inclination of the mind which naturally works from the whole to the parts. The child will be more at ease mentally if he understands the result before he begins, and this will make the lesson a smoother progress for both teacher and pupil.

To learn to baste, put together evenly the top and bottom of a small piece of cloth. Take the cloth between the thumb and fingers of each hand, fold the top over toward you about one inch deep, hold the cloth tightly, and with the left thumb nail and the left forefinger make a sharp crease along the top of the fold. Lift the right thumb, make a few folds of the creased cloth, and pinch them tightly. Do this across the cloth, open it and you will have a straight line to sew by. This little preparatory movement will soon become easy, as it has to be repeated with many things that are done.

To baste on the creased line, have a knot in the thread, and at the right of the crease take up one little stitch. Leave the needle there, set the edges of the cloth very true together, and set two pins, one at the end of your line, another in the middle. Now draw the needle through and sew across, taking a long stitch on the outside, and holding the cloth straight before you between the thumb and finger tips of each hand.

It is best to take the trouble to baste almost any work that is to be done. It saves puckers in the sewing, it holds the edges of the cloth true, and leaves the hands free for the close work that follows. The basting threads are taken out when the work is quite done. In doing this preliminary work, the child should think of its purpose to hold things true, rather than of an exact and special nicety in the stitches. It is a good practice; it guides the eye and the hand to a method and a result. The question should always be whether the sewing is helping the work as a whole, rather than how the stitches may look.

To work the basting stitch on the sampler, run one line of three threads up and five down.

To Run.—As children can easily see, running is used for long light lines of work—for tucking, and for seams that have no great strain upon them. It is a convenient, quick way of fastening any two edges together, the needle *running* along, after some practice, with swiftness. To run, make a knot in the thread. Take the work in the left hand. The baste is, of course, in its place, holding two edges of the cloth together. The run is to be made just below the basting. At the right-hand corner, set the needle between the two edges of the cloth, pointing the way it is to go, straight across. Take small regular stitches, an even amount of cloth up and down, holding the needle and work between the thumb and forefinger of

the right hand, and taking the stitches against the ball of the left forefinger.

There are many motions to be learned in all this first use of the hands in sewing. The alternate lift and fall of the forefinger of the right hand to set and to free the needle, the push with the thimble finger, the drawing out of the thread; and this, with the teaching of the eye to see and to guide the work, makes the practice valuable to the child. It is this training of the muscles to obey the idea that the mother should think of in this first work. It is true she teaches the technical movements; she teaches to baste and to run, and leads the child to compare his work with that of a good model so that he may see what he is trying to do, and what excellence is; but all the time the emphasis lies naturally in the physical action of the child, as a sign of his own force adapting itself to the limitation and the law of a given material and of a regular trained action. This new spirit of adaptation of the force within to the force without, needs encouragement. The power will straighten itself out, and in time the sewing will be good, but at first every effort should be sustained by encouraging words rather than depressed by criticism of the result.

On the sampler skip three lines, then make one line of running stitches, even up and down.

To Gather.—It is often necessary to gather up a long line of material so that it can fit into a shorter space, as a belt or a collar or a wristband. The stitch is horizontal. In running, the stitch is even, or nearly so. In gathering, the rule is one short stitch, then a space twice as long before taking the next. If you take up two threads, pass over four. This gives even gathers. A No. 8 needle with No. 40 cotton is right for use on cotton or gingham, although a practiced worker often prefers a finer thread. The thread should be a little longer than the band for which the gathering is to be made. A fine thread doubled holds the gathers best, but is not so easily used by beginners. The knot must be strong.

To gather, hold the right side of the cloth toward you. Hold the work in the left hand resting on the ball of the forefinger. Put the needle through from the wrong side and take a tiny stitch to make it hold firmly. Point the needle along the crease of the cloth the way the gathers are to go, take two stitches at a time, then draw the thread through. If the thread breaks, go back and begin again. When the end is reached, draw off the needle and make a knot in the thread. Set a pin up and down, at this end, draw up the gathers and wind the thread over and under the pin. Now place or lay the gathers. Take a larger needle, hold the work in the left hand, and with the

needle lay each gather back smoothly, pressing it down with the thumb. In this you work back from left to right, and end where you began to sew.

In gathering, the parts are to be measured. The middle of the cloth and the middle of the band should each have a notch and these should be set together when the work is basted. A double gathering or gauging is sometimes used. This is good for woolen materials and the stitches are to be longer than in fine cotton. The stitch must always be lengthened when there is much cloth to be put into a short band, for this makes the gathers deeper. In double gathering, the thread nearest the top is first put in. The second thread is to be set on a line below it — about half an inch lower. The first line of gathers is not to be drawn up. The stitches on the second line are to be directly under those of the first. At the end take both threads in hand, and draw the gathers gently up to the length of the band they are to fit. They do not need placing. In all gathering, if the raw edge is to be put inside the band, the gathers are run through the cloth singly. If not, the edge must be turned down, and the gathers run through it double.

In fine materials, as Swiss muslin, a close gathering or shirring is often used, to draw the goods into puffs. This is done with finer needles and thread. Two fine runs may be made one-quarter inch apart, and an inch or more below this two more rows may be run to match those above. When all are done, the threads are to be drawn up and the shirring arranged evenly upon them. This work belongs, however, to dressmaking rather than to children's sewing.

On the sampler, skip three lines, then run a line to show the gathering stitch, two down, one up.

To Stitch. — The next horizontal line in sewing is called stitching. In what has been done so far we have had a stitch and a space clear across the work. Now we are to have a line of stitches set close together, showing no space between. This makes a solid line of thread on the outside of the cloth, and gives a very nice finish to many kinds of work. To do this, one should have a very true line of basting and should work close below it. A sharp crease will also be a help. A No. 8 needle and No. 50 cotton can be used for practice on soft cotton cloth. Make a knot and, beginning at the right one-eighth of an inch from the end, put the needle through to the outside, holding the work over the ball of the left forefinger. Now take the point of the needle back two or three threads, to the right, and push it out just as far beyond the starting point, to the left. In this work the thread is always in the middle of the long stitch that the needle keeps taking on the wrong side.

This close stitching has always been used for the finishing of linen collars and cuffs. It is the stitch that appears on the outside of all sewing-machine work. It is rarely done by hand now, except for special use and in embroidery and worsted work, yet if hand-sewing is done, this is the stitch for all seams that are to bear a strain, as in a dress waist, or children's clothing.

There is also a half-backstitch made by leaving half of the space uncovered, putting the needle half way back only; and there is a third way — running and a backstitch — three stitches running and one backstitch to strengthen and hold a seam. These are used for inside work and on short seams.

On the sampler, skip three lines of canvas, then make a line of stitching, covering every thread as you go. Set a line of backstitch two threads below.

To Hem. — We now come to the slanting stitches, for, next to those already learned, these small stitches, slanting both ways, are most in use. The first is for hemming.

To make a hem, a straight edge of cloth is to be folded over toward you one quarter of an inch, and creased down. The cloth is then folded over again, in the same way, and basted down any width that may be wanted. As we see by looking at common things, handkerchiefs or aprons, hems can be as deep as your finger, or more, or as narrow as fingers can fold. A wide hem should be measured with a little rule every two or three inches, and in woolen goods it is best to baste the first fold, as the fiber of the stuff will not crease. This will secure evenness, and the beauty of a hem lies in its being true and even.

To hem, we make no knot. For gingham or fine cotton, use a No. 9 needle and No. 70 or 80 cotton. Begin at the right, put the needle under the fold, pointing away from you to the right about one quarter of an inch from the end. Draw the needle through carefully, leave a little end of the thread showing, take the needle and tuck it under the fold and sew it down as you begin to hem.

Hold the cloth over the left forefinger. Keep it in place with the help of the long finger beyond. The needle will point across the cloth the way of the hem. Take up one or two threads of the cloth and also one or two threads of the fold. Draw the thread through and go on repeating the stitch. In time it is easy to set the stitches close, and to have them all slant alike, from right to left. When a new thread is needed, the end of the old one can be tucked under the fold, and the new thread start just where the other left off, as at the beginning.

If there are seams or stripes in work that is to be hemmed, they should be made to match exactly. If the hem is not to turn a corner,

as in a handkerchief, but is to be straight, as in an apron, the ends should be sewed over and over before the hemming is done.

To make a line of hemming stitches on the sampler, lay them over a single thread of the canvas.

To Overhand.— If we watch the motions of a person who is taking this stitch, we see at once what it means, for the hand is constantly carrying the needle and thread over the seam, from back to front.

We use the stitch to sew together two selvedges or two folds of cloth. Lay the edges evenly together and baste them just below. Use a No. 8 needle and No. 60 or 70 thread. Hold the work as in hemming. Begin without a knot, holding the loose end of the thread down with the first two or three stitches. Put the needle over the cloth, point it then directly toward you. If the needle is put through perfectly straight, the stitches will lie in a regular slant, which will be the reverse of the slant in hemming. At the end of the seam, take three or four stitches back to fasten the thread. When this seam is done, it can be laid flat. Take out the baste, open the seam, and rub it down with the thumb nail.

In this work, the difficulty is to hold both cloth and needle steady, putting the needle in straight to keep from fullness. It is a good plan to use a check or stripe and to keep these even, while one is learning the stitch.

To make the stitch on the sampler, the sewing can be done over a single thread of the canvas.

To Overcast.— Very often the loose edges of seams must have some slanting stitches cast over them, to keep the cloth from raveling. This is overcasting. The stitch is nearly the same as in overhanding, but the needle need not be set quite so straight. Hold the cloth over the left forefinger, make a knot in the thread, begin at the right hand up over the left thumb. The stitches should be about an eighth of an inch deep and about a quarter of an inch apart. They must not be drawn too tightly.

Overcasting is simple, but it is not so easy as it at first seems to be. If a child learns the principle, however, and the use of the stitch, the practice and appearance will come in time.

In working this on the sampler, the stitch should be taken over two threads of the canvas.

The Buttonhole.— We leave now the slanting stitches and come to the vertical — to those that stand up and down. In contrast to other stitches taken in sewing, these are few in number but they are useful and effective.

To make a buttonhole on white cotton, take a No. 9 needle and No. 60 cotton. Cut the slit a quarter of an inch from the edge of

the cloth. Hold it across the left forefinger, and with one or two small stitches at each corner, and with long stitches down each side, make the strands or bars that help to secure the edge of the buttonhole. Overcast this barring so that it will stay in place.

To make the buttonhole stitch, or purl, begin at the end of the buttonhole farthest inward. Take up three or four threads, push the needle half-way through, with the right hand take up the two threads as they lie in the eye of the needle, put them over the point and draw the needle through. The buttonhole is to be rounded at the end that points outward. It is to be drawn close together at the inward end and barred across with three or four buttonhole stitches.

Before trying to do this work, the sewer should see varieties of buttonholes on heavy and light materials, and should have a clear idea of all the steps that are to be taken. These can be shown and learned best by work on canvas, with colored wool and large stitches; or colored embroidery cotton can be used on white goods. The buttonhole should always be strong, and if it is also handsomely made, it becomes one of the finest points of finish for our nicest garments. On the sampler, a button hole can be worked without cutting a slit.

The Eyelethole.—This is to be punched through the material with a stiletto. To keep the hole round, use the little tool now and then while working. The eyelet can be worked with the buttonhole stitch. It can have the corded edge inside, or lying in a circle outside with the single stitches pointing to the center; or it can be sewed very closely over and over, with strong thread and even stitches.

To Darn.—To darn is to weave new threads where old ones have been cut or torn apart, or where a place has worn thin and needs staying. Darning is an old and familiar process. In the days when goods were not only made up but were also woven at home, cloth had a high value, and the darn was culitvated to an extent that has now gone out of fashion. To-day materials are bought for low prices, and a mother spends less time in repairing, and gives more thought to the supply of new garments for the family. But the darn can never go out of use, and to be skilful in making it, is often to be a friend in need.

The stitches for darning must be taken according to the tear. If the tear is straight across the cloth, the stitches will be taken up and down. If the tear is up and down, the stitches will go back and forth across it—or they may better lie in a long slant, and be woven into the material to draw it together, showing as little as possible. If the tear lies in a slant across the cloth, the stitches of the darn are to be taken up and down, side by side, following, however, the tear itself.

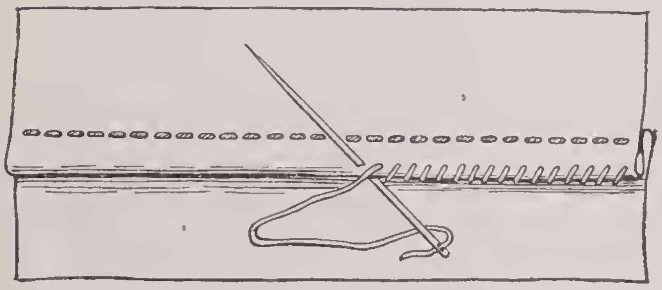
If it is necessary to put a piece of the cloth underneath a tear to give strength to the darning, it should be placed with care, thread for thread, on the goods, so that the two will pull together evenly.

A few simple principles underlie all this handling and sewing of materials. In learning any process, the child should be made to understand what is really to be done, and to see the relation of his own sewing to the work that was done by the machine in preparing the goods. This gives a mental impression that enlarges the intelligence, and awakens a sense of relationship in "doing," which makes the work educational, and saves it from being merely an industry pursued for the sake of a narrow, purely personal end.

It is with these few stitches that the great variety of our usual plain sewing is done. In all the making and finishing of garments they are used, one with another, to produce different effects.

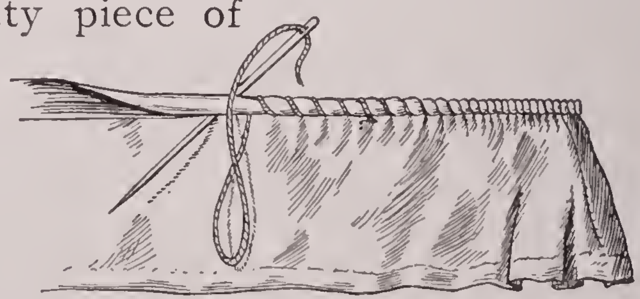
The French Seam.— A very nice seam, for instance, is the French seam. The two edges of cloth are run together first on the right side of the garment. The cloth is then turned, and the seam is made as usual on the wrong side of the garment, thus inclosing the raw edges between the two seams. The stitch is a fine run or run and backstitch.

French Hem.— There is also a French hem that is sometimes used on linen or on damask table-linen. For this, first fold a very narrow hem. Hold it toward you, fold the cloth back even with the bottom of the hem, crease it sharply, and with a fine needle and thread overhand the edges, laying them flat when the work is done.



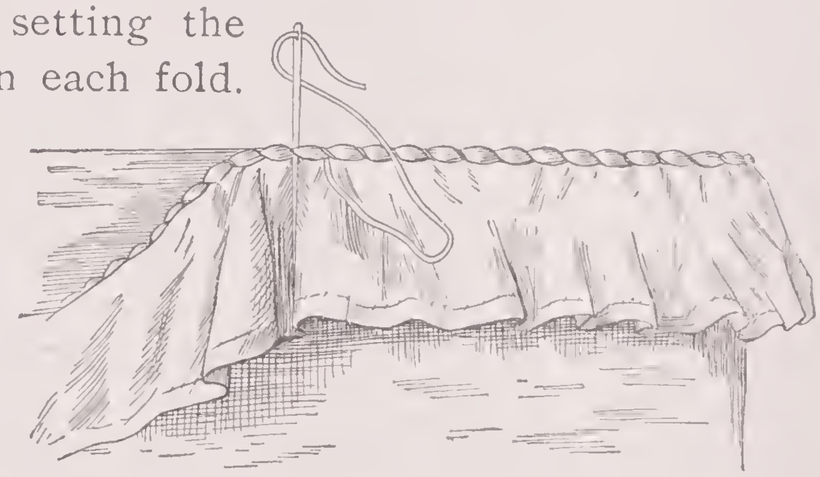
Felling.— Another nice finish to work is the felling of seams. To fell is to hem. First run the seam, or use a run and backstitch. Trim one edge of the seam down so that the other remains a little wider, or in preparing the seam for felling, one edge may be basted an eighth of an inch below the other. Fold the wide edge over the narrow one, and with a fine needle hem it down, keeping all threads tucked under with the point of the needle.

Whipping.— To whip is to gather by use of an overcasting or a hemming stitch. This is a very pretty piece of work to do. The materials, needle, and thread must all be delicate and fine. The use of the whip is for making ruffles. The strips of ruffling may be of any width. A good material for use in learning is cambric. After that, finer muslin may be used.



To whip, hold the wrong side of the goods toward you. With very clean fingers, begin at the right-hand corner, and with the left forefinger and thumb roll an inch or less of the material. Have a knotted thread — No. 50 cotton and a No. 7 needle are suitable. Take one or two close stitches to fasten the thread firmly. Hold the cambric tightly between the thumbs and forefingers, and continue to make the small close roll between the left finger and thumb. Hold the roll over the left finger, and take overcasting stitches over the roll, or hemming stitches up through it. Set the stitches evenly. Before beginning, the ruffle should be measured into half and quarter lengths, and the thread for whipping may be for half or for a quarter of the length. If too long, it is liable to break.

To gather the ruffle, draw up the thread and fasten it about a pin at the end. If the ruffle is to be sewed to a band or to a hem, as at the bottom of a sleeve or of an apron, the half and quarter should be pinned evenly in place. Then, holding the ruffle toward you, with the overhand stitch, take up each gather, setting the needle so that the thread will come between each fold.



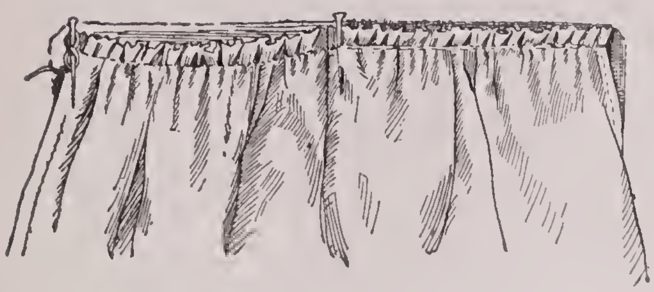
Ruffles.—Many times a ruffle is put on a garment in other ways. A thread can be run in an eighth of an inch from the top, the gathers laid very smooth and even, the ruffle basted to a band, and the gathers backstitched down. If this band is to be used as a facing, the bottom of the garment to be trimmed must be also basted even with the facing and sewed in with it. In this case the ruffle falls from between the facing and the outside material. The facing is then to be turned up, basted carefully, and hemmed at the top.

A ruffle may also be made with a heading. To do this, after the lower edge is hemmed, fold over the upper edge an inch or less, and at any depth that is desired run a thread through this fold. One or two threads may be run below, especially if the ruffle is of woolen goods. Sew through the gathers to the garment below, after careful basting and measurement.

To Put on a Binding.—Bindings or bands are often needed when material is to hang full, having been gathered. For straight bands, such as the wrists of sleeves, or for any waist bands whatever, the cloth should be cut the long way of the threads, as they pull more evenly, and hold the garment in place better than cross-cut bands.

The middle of the band must be marked by a notch. The middle of the gathered material must also be marked. Lay the outside of the band against the outside of the gathers, setting the edges even. With

a strong thread, baste the gathers to the band, just above the gathering thread. To do this, take one or two stitches at the right, loosen the gathering thread, make it the length of the band, and wind it again around the pin at the left, which should also fasten the gathers to the band at the end. Set another pin in the middle to fasten the two notches together. Now baste the gathers across. Just below the baste, on the gathering thread, stitch the gathers to the band. Take out the baste. Turn over the band, crease down the edge and the two ends, trim off the corners of the gathers, fold the band down on the inside even with the outside, baste it, and with a stitch in each gather hem the band down, not allowing the stitches to show through to the right side. The ends of the band should be overcast before hemming down, and in cutting the band the ends may be cut slanting, so that they will offer less material to sew through.



If a band is to be put on delicate lawn, or any very fine material, the gathers can be basted as before, and the band can be hemmed down first on the outside, and then on the inside, with fine thread and very even and fine stitches.

To Make a Button Bag. — As soon as the needle can be used and stitches can be taken with some knowledge of their purpose, the child naturally proposes to make something with them. Whatever is undertaken should be as short a piece of work as possible. In contrast to the idea that "patient continuance in well-doing" should be taught by a child's overhanding the seam of a sheet, and taking it out if not done well, the modern teacher comprehends that the child conceives the picture or thought of a whole thing, and that encouragement lies in the ability to produce it without too much time spent on the way. So the little bag presents itself as something possible, and also attractive and useful.

To make a bag, select a blue checked gingham. The piece may be twelve inches long, and four in width. Turn the material wrong side out, and baste. The sides are then to be stitched from the bottom up to within two inches and a half of the top, when the thread is to be well fastened. The seams should be overcast. Next fold a very narrow hem from the seam up to the top, on the four open edges. Fold over the top of the bag for a hem, just even with the end of the seam, and hem it down. Just above, run a line of stitches, fine and close. This makes a casing. With a tape-needle, run in two strings of very narrow linen tape, one to draw each way, and to fasten

these lay the ends flat, one on another, sewing them down hard and tight, along the edge and across. The tape can then be slipped along until the joined place is in the casing. For this work, use No. 70 cotton and a No. 9 needle.

To Make a Muslin Apron.—A muslin apron of white plaid nainsook is interesting to a child and very good practice. The needle may be No. 10 and the cotton No. 90 or 100. The length of the apron must be measured for the child who is to wear it. The width also should be in proportion to the height and size of the figure. The hem at the bottom can be of any chosen depth, but this must be decided and allowed for in cutting. The sides of the apron should have hems one eighth of an inch in width. The top is to be gathered, the band basted on, middle to middle, the two are to be stitched together, the band turned down, basted and hemmed down, one stitch for each gather. If strings are to be made, they should be hemmed, laid in one deep plait to match the width of the band, and sewed closely with a French seam.

Cutting Out.—When the child comes to the making of things to use or to wear, the first step is the choice and cutting of the material. In the first place comes the suitability of goods for a certain use, the study of weight, texture, fabric, and general appearance; and with this comes also the kind of sewing that the cloth may require to hold it. These things, familiar to the mature mind, offer points for information, for observation, and for pleasant task among the children. If time is given, the unfolding of new material, and the comparison of weavings, will occupy a child for some time. In a class where results are to be reached at a given time, the teacher is not at liberty to let children lead in these matters; but in a small class, or especially with the mother at home, it is well to linger over every single point until interest flags. The result will be some growth of thought, and it should be remembered that thought takes time, and that much thought may arise in the mind from simplest starting points and from things that in themselves are ordinary and usual.

The process of cutting is the movement from the general to the particular. It prefaces the development of an idea. In this lies its first interest. It calls for the use of the scissors, and here all children find enjoyment. Unlike cutting a thing for destruction, or from the undirected impulse of force, astir within and trying to find a way of expression for itself, this guided and limited cutting is a step in progress. It destroys the material in its first unity so that it shall be representative in a higher degree of the life, the labor, the device and the industry of man; it puts the product of nature, whatever the fabric, to its highest use in intimate association with human life.

In cutting a garment from cloth, the threads of the goods are the guides. If a child has been trained in the kindergarten, he will be familiar with inches as a standard in measurement, he will know his right hand from his left, and will be in the habit of watching the up and down of lines, the straight crossing from side to side, and the slants of lines at different angles. What is bias in cutting and sewing, he will have learned, first as the true diagonal of the square, afterward as the varying lines of his triangular tablets, his paper folding, and his sewing. If a child has not had that training, it will be necessary to study the lines of cloth, to show how with the line of the woof folded true to the side of the warp, the exact bias is found — which is necessary for cutting a silk or velvet collar, for cutting a bias ruffle, etc.; and how, following exact patterns, many other slanting lines are to be cut, as for the breadth of skirts, the shaping of waists and of sleeves.

With these things comes the observance of inside and out, the up and down, the cutting to match a stripe, or to set a flower on a vine after the order of nature, and not upside down.

In teaching children to sew, all directions should be clearly given and all stitches should be made plain to them. For this purpose, a board checked in squares can be used for illustration of a stitch, or, better still, a piece of coarse canvas or crash can be hung before the class, or handed about among the sewers to show just how a stitch is to be taken and how it appears when done.

In sewing there is no invention of new stitches to be looked for. The process remains the same. But as fast as stitches are learned, the children may have liberty to apply them as they please, in any shape, or form, or use of material, that is sufficiently simple to be finished. The end should not be too far off from the beginning; and also whatever is begun should be carried through to the end, and put to some use, invariably.

In the methods of work, too, it is wise to allow as much freedom to each child as does not interfere with progress. It is customary for stitches to be taken with the right hand, and for work to be held so that the sewing, in general, is done toward the person. But it is noticeable that many bright children have ways of their own, using both hands alike, or reversing work, and doing it outward and away from the person. In all these individual ways, it is best to allow time and freedom and to observe the result. To enforce tradition often baffles a child, and hinders progress. The result, the ease, the swiftness, the accuracy desired, may be much more easily gained in one way, than in another.

As in teaching writing the letters may be made on a board, or on paper, and the child left to hold his pen or pencil just as he

likes, so that he makes plain, clear letters and words, so in sewing it is well to show the stitch and the usual way of taking it, but if variations occur, these should be studied and observed, and perhaps allowed. For among grown people it is noticeable that, as in writing each takes his own way and holds his pen as he pleases, so in sewing the needle is held differently by different hands.

There are of course some general principles that are of use to any one — the habit of holding a needle lightly to avoid a strain upon the muscles; taking it far enough from the point to get easy control of it for the stitch, and with the thimble finger; holding the work gently so that its edges fit together easily; and an easy upright position for the body, on a seat low enough to make the lap straight for work to rest upon.

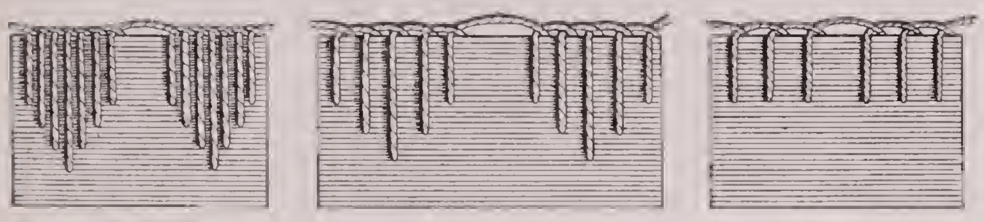
Ornamental Stitches.— Besides the cutting and sewing of garments, there is a field for needlework in the decoration of things that are made for daily use. For this we have embroidery,— the application of designs beautiful in form and line, and brought out in color carefully studied and harmoniously related.

To embroider with elegance is the fine art of needlework. It covers a wide field of knowledge and of skill, and has been pursued with labor and with love by the people of every great nation. Eastern embroideries are now well known to us through the importation of goods from India, China, and Japan, and from the markets of Persia and Turkey. In our museums we treasure the fragments of Egyptian fabrics, finding in them much beautiful suggestion as to lines and harmonies of color. Indeed, from all ancient work in textile fabrics, and especially in design for different kinds of material, and the use of certain forms and colors for especial uses, and in the modern oriental work, also, the people of Europe and of this newer western country have always much to learn.

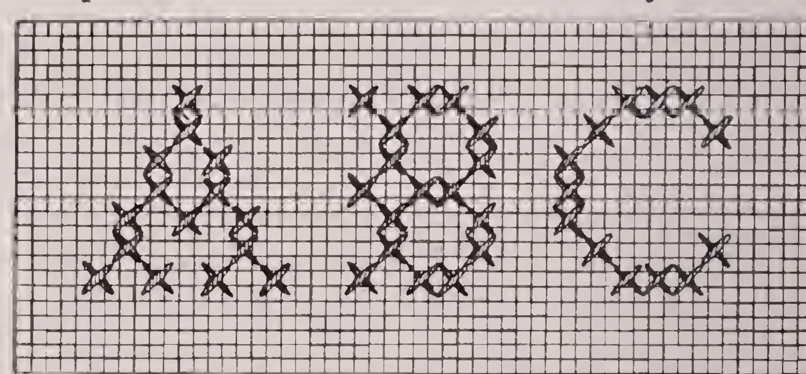
But this art of embroidery applied to shawls, scarfs, and laces, and to the heavier garments of both men and women, stands quite apart from sewing. It is decoration. It follows upon the earlier skill of the needle which is confined to the first making of things, and as artwork it has its own methods, peculiar to each people, which have to be learned over and above all knowledge of sewing. But while this is true, there are a few very simple ornamental stitches that can be learned as soon as the child begins to understand the needle, and the management of thread and material.

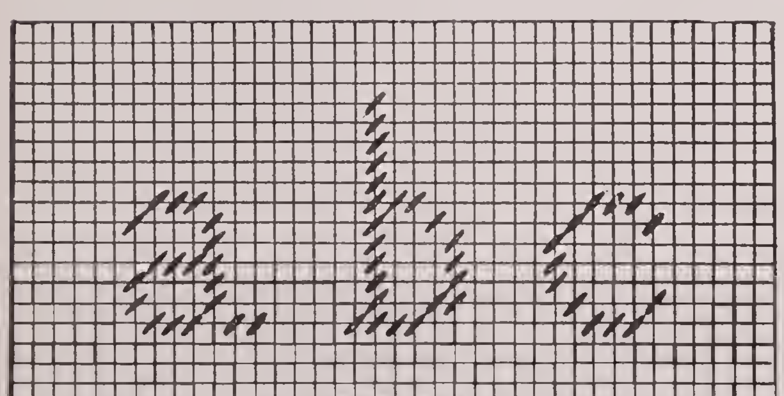
The Blanket-stitch.— This is a vertical stitch, suitable and convenient for the finish of raw edges. It is used often on blankets, to keep the edge from raveling. The stitch can be learned on canvas, or on heavy flannel. Use a worsted needle, and zephyr or Saxony wool. Hold the edge of the flannel toward you and work from left to right.

Begin by taking one or two running stitches from a point one quarter of an inch above the edge, straight downward. This brings the needle to the edge of the cloth, ready for the work. Cover the running stitches with one long one, bringing the needle out again on the edge. Hold the thread under the left thumb, pass one-quarter inch to the right, take a stitch straight up and down, parallel to the first, drawing the needle through over the thread and taking care to hold it loosely and evenly on the edge of the work. The blanket stitch can be taken at any distance, close or far apart, and the height of the stitches can be varied, graded, and alternated at pleasure.

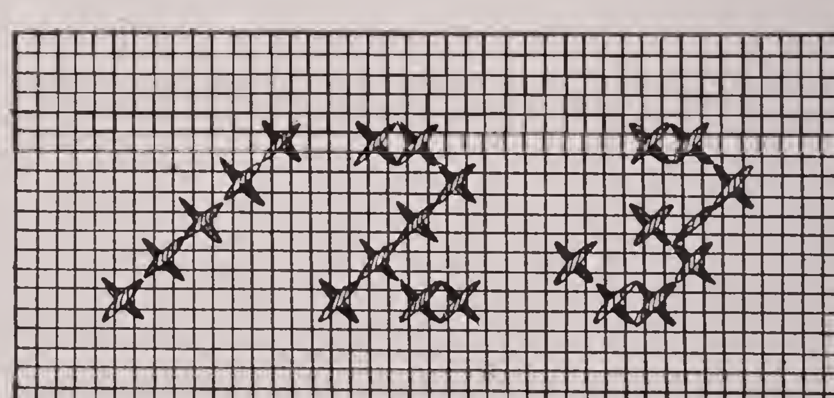


The Marking-stitch. — This may be learned on canvas, with clearly open spaces. It is the simple cross-stitch. Its beauty lies in having all the stitches crossed in the same way, to give a uniform slant on the outside. Letters, capital and small, and figures, can be made, and also simple borders for burlap — a pen-wiper cover, little mats, a splasher, or a bureau-scarf. The large letters should be learned first, and the canvas and worsted should be coarse rather than fine.



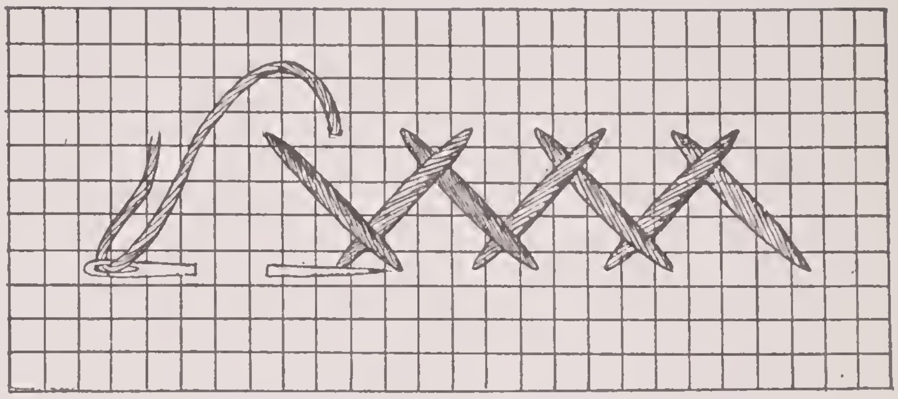


To make the stitch, we notice that each one fills a square of the canvas. The child should see this by looking at stitches ready-made before beginning. The square may be two threads of the canvas. The outside stitches may slant from left to right. To begin, draw the thread from underneath through the lower right-hand corner of the square, and cross to the upper left-hand corner. This makes a diagonal. Bring out the needle at the lower left-hand corner, and cross the thread to the upper right-hand, making a second diagonal. This may be done as a first exercise by making a larger stitch across half-a-dozen threads of the canvas.



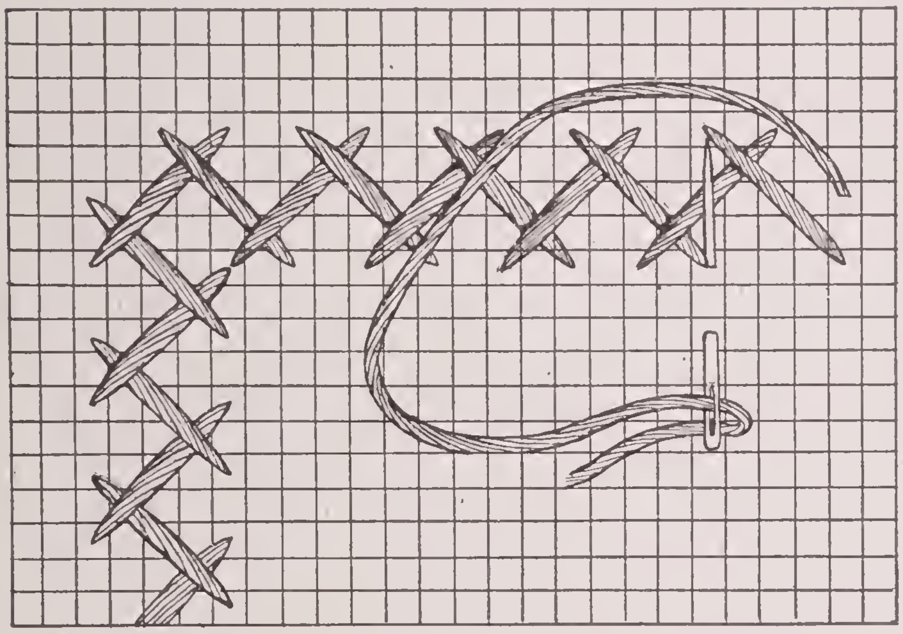
In making the stitch, care should be taken to fasten the thread without a knot, and to cut off the worsted between each two letters or figures, sewing the end down

with a stitch or two on the back. For fine marking, when the stitch has been well learned, baste a piece of open-meshed scrim over the linen, work the letter, then carefully pull out the threads of the scrim.



Herring-bone or Catch-stitch. — Another cross-stitch, which is used to finish seams, is also to be learned on canvas. The work may run up and down or across the material, but it is made of one width throughout, and stands on two parallel lines of the canvas. These may be four or more squares apart.

To make the catch-stitch, begin on the line, at the lower left-hand corner, bringing the thread up from underneath. Hold the canvas over the left forefinger. Count to the right six threads, for a first lesson, then upward on the canvas count the same number. At that point put in the needle and, turning it directly downward toward yourself, bring it out three threads below. The needle must go in and come out exactly on the lines. This will give the work precision, and make it suitable for ornament.

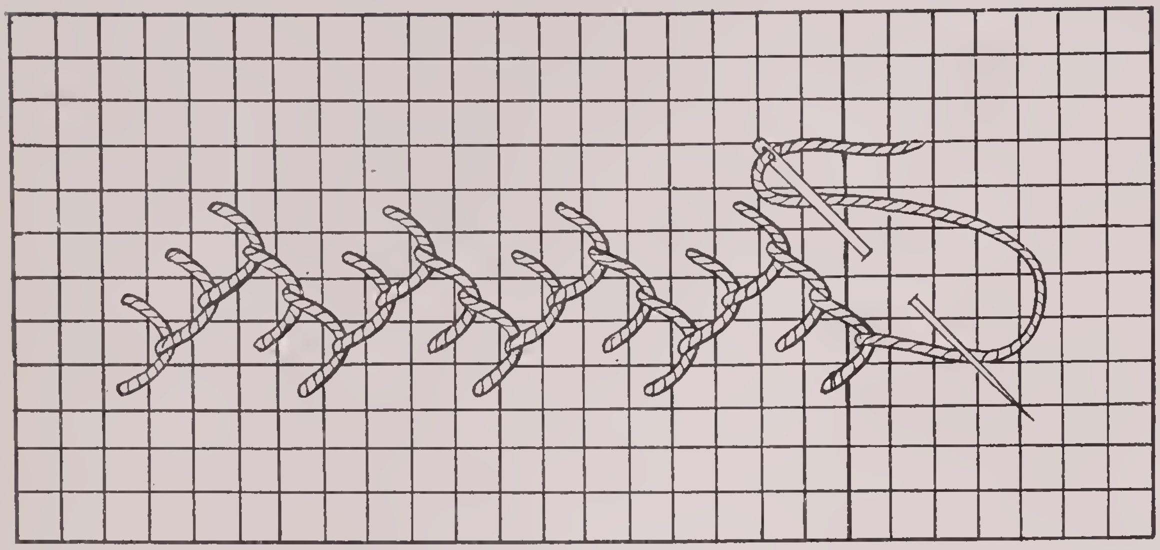


To go on with the work, reverse what has just been done. Count to the *left* six threads from the place where the needle comes through, and six threads upward. Then, as before, take up three threads of the canvas, pointing the needle straight down the line. After this, work again to the right. This brings the stitches in regular alternation, the small crosses opposite the open spaces.

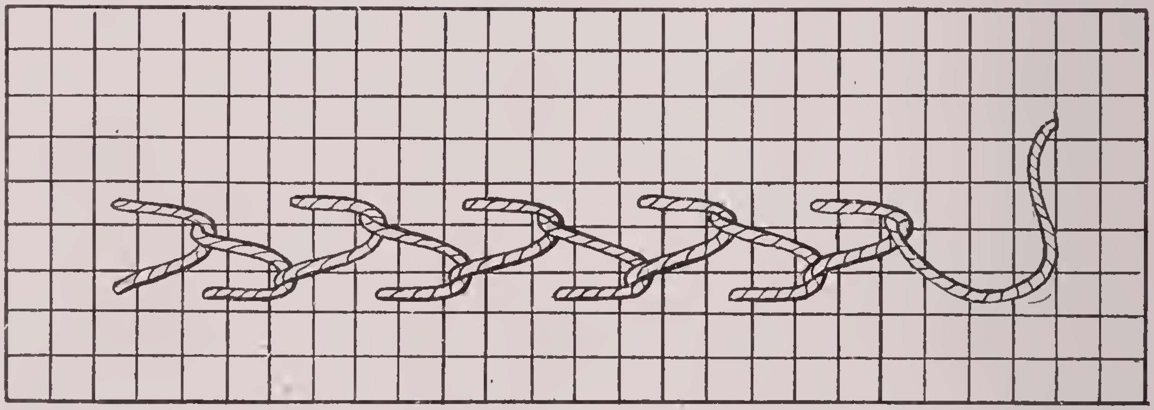
To turn the corner, take a stitch from left to right, but at the right change the course of the needle, pointing not downward but straight across to the left. Take up three threads. Turn the canvas on the left forefinger and work along the new side, as before, taking the stitches away from you. This catch-stitch can be used to hold open the seams of flannel, or to hold down any raw edge when a hem is not wanted.

Feather-stitch. — In making this stitch, hold the canvas over the left forefinger, and work toward you. The stitches are to lie between two parallel threads of the canvas. To make a large stitch while learning, four threads may be taken for the width of the sewing.

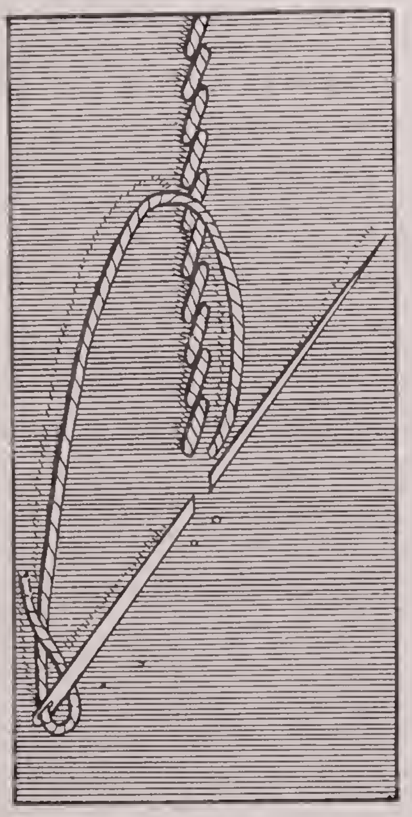
Begin at the upper left-hand corner. Draw the thread through and pass it under the left thumb. With the needle turn to the right, count three threads of canvas; then, exactly on a line with the first stitch, put in the needle, point it toward you, and take up three threads of the canvas, always holding the thread under the left thumb until it is drawn into place. Take the stitches in regular alternation. From the right count three threads to the left, point the needle toward you and take up three threads.



In this way, the stitching appears branching and with slanting lines, but the work itself is done by taking steps up and down, right and left, with no change and with no slant to the needle at any point.



Feather-stitching can be made wider by taking up several threads in succession on each side. If the needle is at the right, instead of next taking one stitch only at the left, continue to go to the left, counting three threads down from where the needle last came out, and then three down. Doing this will bring a slanting line of stitches into view. When three have been so made, reverse, and do the same thing at the right. The needle follows the threads of the cloth, always keeping true to the lines from which the work was started. When this stitch has been learned, it can be worked on flannel skirts for a doll, or for a child herself, or as an ornament to a crib blanket, or an infant's wrapper.



Kensington Outline-stitch.—A pretty stitch for outlining a design upon crash, heavy linen, or upon any material taking silk or wool decoration, is made in this way: Hold the cloth over the left forefinger and do the work from you. The sewing is to run along a single line at a time, not requiring any guide but the line of canvas that is being followed. From underneath at the lower end bring the needle through. Count three threads to the right and, from there, about one

eighth of an inch above, put the needle into the cloth, pointing in a slant to the left and *downward*, and bringing it out half the distance down to where the thread began. The thread must not be drawn tightly, but must rest easily on the cloth. A heavy linen thread of blue upon white crash, or on white coarse linen, makes a very pretty bureau mat with this stitch.

The stitch is to be repeated in regular order, the end of each underlying the beginning of the next, the thread having thus the semblance of a twist along the line.

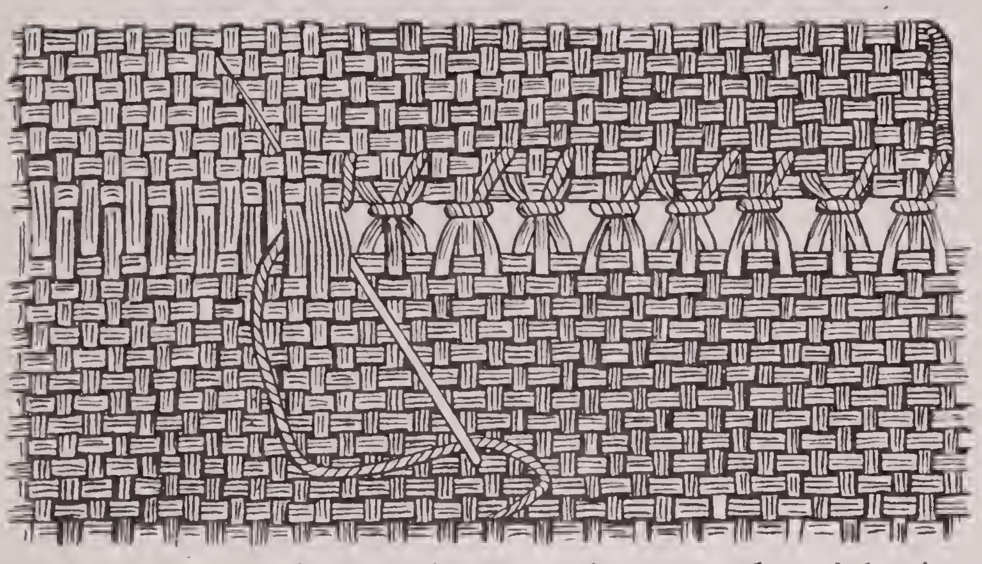
The Chain-stitch.—This is an exceedingly simple stitch, easily learned, and sometimes of use in making a border above a fringe or edging, or to outline a design. It can be taught with embroidery silk on muslin, or with worsted upon canvas. The stitch is made toward you, the cloth being held over the forefinger. Begin at the upper end, draw the thread through, pass it under the left thumb, set the needle exactly where it came out, point it toward you and draw it through about one-eighth of an inch, or over three or four threads of convas, bringing it up so as to make the thread into a loop. An especial point is to hold the thread down for each stitch and not to draw it too tight at any time. The stitches continue exactly alike and can be taken along any line.

To Hemstitch.—Among ornamental stitches, nothing is so much used as hemstitching. It gives a simple line of decoration that is delicate and elegant, yet is equally suitable to light or to heavy fabrics. It is beautiful wherever seen — on the hems of sheets and pillow cases, on linen for the table, on ruffles of lawn, and on lawn and linen collars, and above all it is the chosen finish for handkerchiefs, of every size and description.

It is one of the most useful of all stitches, as it is not an addition merely to what has already been made, but is in itself the hem, holding down and finishing the raw edges of articles. The stitch itself is hemming, but it moves backward as well as forward, and the work is specially prepared by drawing out some of the threads of the goods. To do this, it is well to practise on a piece of soft crash.

First, four or five threads are to be drawn out across the goods. If a coarse thread is taken first, it can be started with the point of the needle. Take the end of the thread in the right hand, hold the cloth in the left, working the gathers gently to the right. After the first thread is drawn, the others come out easily. When the threads are drawn, we have only the up and down threads left. The top of the crash should now be folded over very narrow, and then folded again to meet the edge of the drawing, and basted down.

To hemstitch this edge down, choose a certain number of threads to take up each time — three or four. Make a knot, put the needle under the first cluster of threads and bring it out between them.



Now carry it back, and take up the same threads again, but bring the needle out this time through the fold of the hem. When the thread is set back over the cluster of cross-threads, it must be drawn tight. This gathers the threads, binding them like tiny sheaves, broad at the base and with clear spaces between, toward the top. Each of these clusters is sewed with its own stitch to the hem above, and the hem is made secure with a line of spacing below, that is distinct and that gives character to a plain surface.

To those who by practice learn to do hemstitching easily, the making of fine linen handkerchiefs is a pleasure. A small square of linen lawn can be cut, allowing for a wide hem, or one of any width, even exceedingly narrow. The needle should be a No. 10 or a No. 12; the cotton No. 100 or 150. In drawing the threads for a handkerchief, they are taken out each way of the square, at even distances from each edge. At the four corners, the drawings cross each other The corners are folded over square, and basted down very flat. The hemstitching extends across each corner to the outer edge of the linen, making a solid square for each corner, with a well-marked space, made clear and strong by the meeting of the stitches that hold the threads.

This drawn-work is trying to the eyes. It should be done on fine materials only, by persons who are mature, and then in a good light, and not too long at a time. But a handkerchief hemstitched by hand is a dainty gift, and for holidays or for weddings, it proves an excellent resource for those who know the work; while on coarse material, children can easily learn the principle of the stitch. All of these stitches can be worked upon the canvas sampler. The blanket-stitch can be used upon the edge.

In a class at school, sewing is done with no reference to the sewing-machine. In a home, where the mother sews, and the family work is done on the machine, the child may not have the pleasure of being with other children, but she still has the incentive of working in companionship with the elders. For as soon as stitches and methods have been learned, they can be applied to the preparation of seams for stitching and to the finishing off of work.

There is also the cutting out, which is so materially aided by the patterns now popularly sold. The instructions given with these are interesting to a child who has begun to study the ways of threads in materials, the virtue of long threads for the length of garments, the needed evenness of threads across them, and the use of bias cuttings to give the pliant yielding that the round human figure requires in what it wears.

In cutting any simple work, a gored skirt, an apron with bib and pockets, a housekeeping apron, or any garment made with a few pieces, a child can easily learn to pin a pattern to material, to observe straight edges and slanting lines, and, when all is right, can help to cut them out. The basting, too, is very good for practice, and the putting parts together, the bias edges to the straight, the careful closing of seams, the allowing for hems,— all things that call for observation, careful handling, and judgment, can well be intrusted to a child who is at work at home. In fact, a cheap print bought for the purpose, and given to a child for experiment in cutting out and basting, may lead to most excellent results.

It is doubtless easier to work on clothes for children than to dress a doll; still, the doll's wardrobe may well be considered, and if it proves an interesting subject of study, there are plenty of patterns that give complete directions as to how the garments are to be cut and made. In this work the cutting is, of course, done after the principle of all good work, and the stitches that are required are those that are taught as the standard ways of sewing. Everything is to be done with absolute accuracy, and everything that is done on larger garments can be worked out for the various grades of dolls — whether they are boys or girls, servants, fine ladies, or children. To be able to dress a doll prettily is an advantage, as is any use of the needle in a special direction. Educationally, it covers all the ground of cutting out and sewing for which learning to sew has prepared the child.

In a family, especially where the life is at all isolated, the fitting up of a doll's house may become a help to a mother in teaching a little daughter to sew. There are the sheets to be made, cases to cut and hem, and both of these to be hemstitched, if that stitch has been learned. There are blankets to be cut, and these must have at each end the blanket-stitch. There can be a coverlet in strips of silk, and these can have the cross or feather-stitch laid on the outside of each seam. There are curtains to make; and these, besides the hem, can have ruffles of edging, or of sheer muslin, or of the curtain material, to be put on with fine, neat whipping and overhanding, or set between the edge of the curtain and a strip for facing, to be hemmed down with fine thread and delicate stitches.

A very pretty toilet-table can be made by taking a small box of a size to suit the doll's room, and nailing on one end of it a half-round — the bottom of a salt-box, for instance, cut across the middle. The straight edge stands against the wall; the circular edge is the front. A padding of cloth and a cover of stout muslin can be tacked on this top, and the stand is then ready for decoration. Here is a good opportunity for any of the finer work that has been learned. The drapery can have a heading, with a cord run in the casing to draw it up. This can be put on with a long needle and stout basting cotton. The top of the stand can have a scarf of linen, hem-stitched, or with a lace edge.

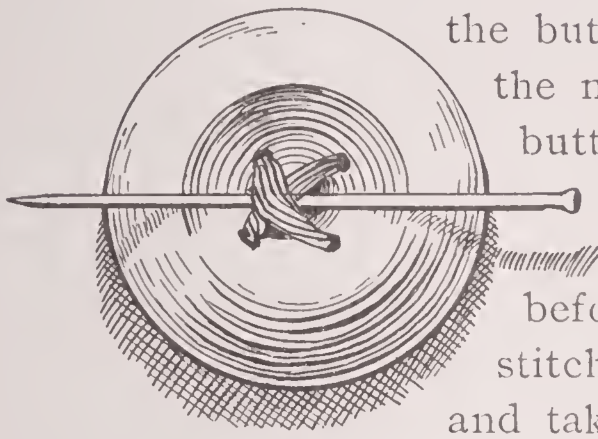
With burlap, very good rugs can be made for the floors. These can be in any design that the child may devise, and worked with the cross-stitch, or the Kensington outline, the edges being finished with the blanket-stitch.

So, for a definite purpose a mother may fill a child's time educationally, using very simple means. In such work as this the materials should be very good. But little is required, and the effect should be an agreeable recompense to any child who has taken an interest in doing the work.

In choosing work for children who are taught to sew separately and not in classes, the individual inclination should be watched and cultivated as much as possible. While the drill and discipline are to be valued and maintained, care must be taken not to force the doing of a thing too long at a time, or to make the work a theme for too close and constant praise or blame. The *spirit* with which the child enters into the work is the vital thing, and work may be poor, even quite bad at first, yet if the fingers have been following the idea of a stitch, — and every stitch is a new idea to a child, — and if the principle of the stitch has been intelligently recognized as a process, and as a result, the teacher should see that the most important point has been gained, and should teach by degrees the things that are the greatest drudgery to a child, and in connection with the effect they are to produce, and to show how useful and how necessary a tedious step may be toward having what we want. In a class there is stimulus and support in the fact that all are doing one thing. With the mother at home, the child may feel the learning more of a task, unless the work hour be made gently and happily companionable.

Buttons. — Most children enjoy sewing buttons on a garment. This is good practice, and the various kinds of buttons may be given at different times, with instructions for each, as a diversion and relief from other sewing.

To sew on a flat button with four holes, the needles may be No. 7 or No. 8, with No. 50 cotton, or coarser if the material has heavy threads. The button may be held in place, and, running a pin through the holes, its place can be marked on the goods. At this point a few stitches, set as a cross, will hold the cloth steady for sewing. Make a knot, having the thread double. Put the needle through from the outside downward, just at the center. This brings the knot where

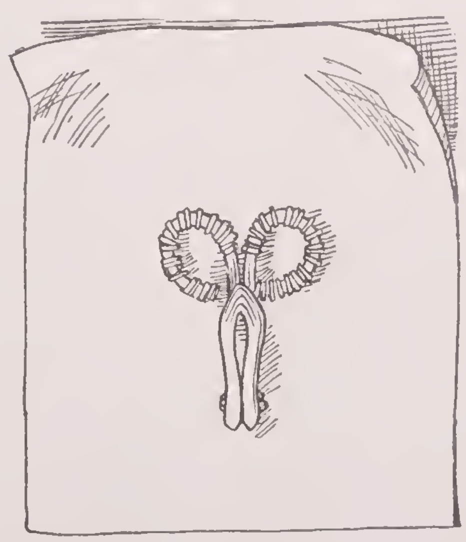


the button will cover it. Close to the knot, push the needle part way through the cloth, put the button on it, and draw the needle through. Make the first stitch through the button an up and down line or a diagonal. But before putting the needle through for that first stitch, lay a pin across the top of the button, and take the stitch over it. Take the next stitch across the button from right to left, or a diagonal to cross the first from right to left. This makes a cross on the outside. Take several stitches each way having, at last, the needle underneath. Now remove the pin. The stitches will be a little loose. Bring the needle up from underneath between the button and the cloth, wind the thread several times round the stitches, drawing them tightly together. Push the needle through, and fasten the thread on the underside.

To sew on lace, crochet, or tailor-made buttons, the needle and thread must be chosen to suit the goods. The stitches are taken through and through in a cross or circle, and the threads wound round to make a neck under the button.

In sewing on a button with a shank, it should be laid on its side and sewed over and over in the middle, with a number of stitches taken well into the goods underneath. This makes a cluster of threads just under the center of the button.

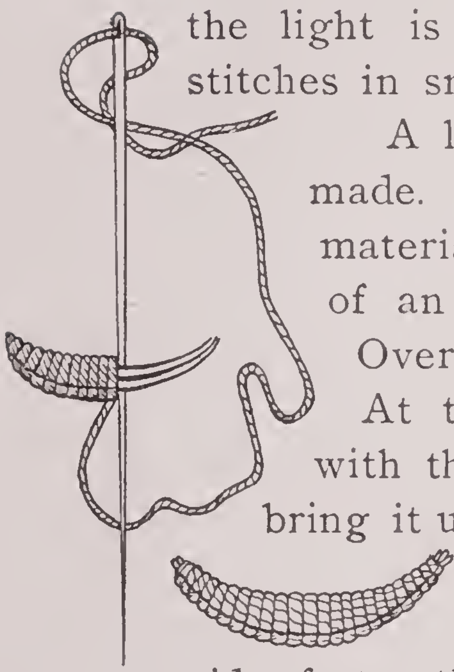
Hooks and Eyes.—Children may also learn to sew on hooks and eyes. These may be placed to fasten from right to left, or the reverse. The needle should be as fine as will do for the thread, as they need to pass through the rings a number of times.



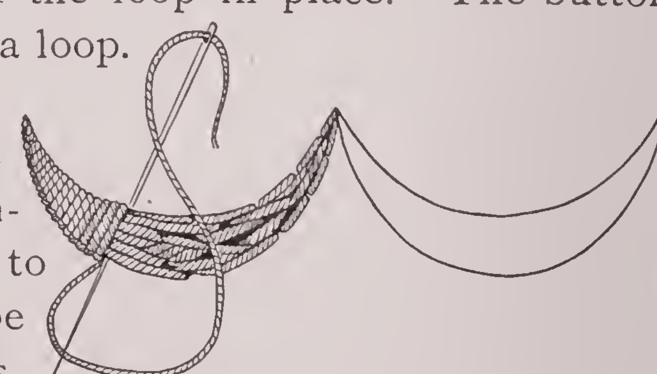
Begin with the eye. It should stand a little over the edge of the cloth, which should be a fold thick enough to bear the strain of fastening. Hold the eye between the left thumb and forefinger. Sew around the circles of the eye, a close over-hand stitch. If the fold

is thick, do not let the stitches show through to the outside. In finishing on each side, sew on from the circle, toward the loops of the eye, some firm, close stitches, and fasten the thread underneath.

To sew the hook, first see how it is to be placed on the cloth opposite the eye. This we do by putting the hook into the eye, and laying on it the cloth, as it should be when fastened. Hold the hook with the left forefinger and thumb and unhook it from the eye. Overhand the two circles as before, fine and close, and continue with the stitches along the back of the hook. To fasten the thread, go back to the circles on the underside and sew several stitches there, on each side, so that it will pull evenly. With large hooks and eyes, this is good practice for a child, but care must always be taken that the light is good, and that the eyes are not strained over close stitches in small spaces.



A loop is often desirable in place of an eye, and is easily made. For cotton goods, No. 40 thread is best, or finer if the material is light. To make the loop, take a stitch one quarter of an inch long across the space where the hook is to fasten. Over this, lay two or three more stitches of the same length. At the left, bring the needle through, hold the thread down with the left thumb, pass the needle under the cross stitches, bring it up over the thread, and draw the thread up lightly. Take the next stitches in the same way, setting them as close as possible all the way across. Then, on the wrong side, fasten the thread securely to hold the loop in place. The buttonhole stitch can be used also in making a loop.



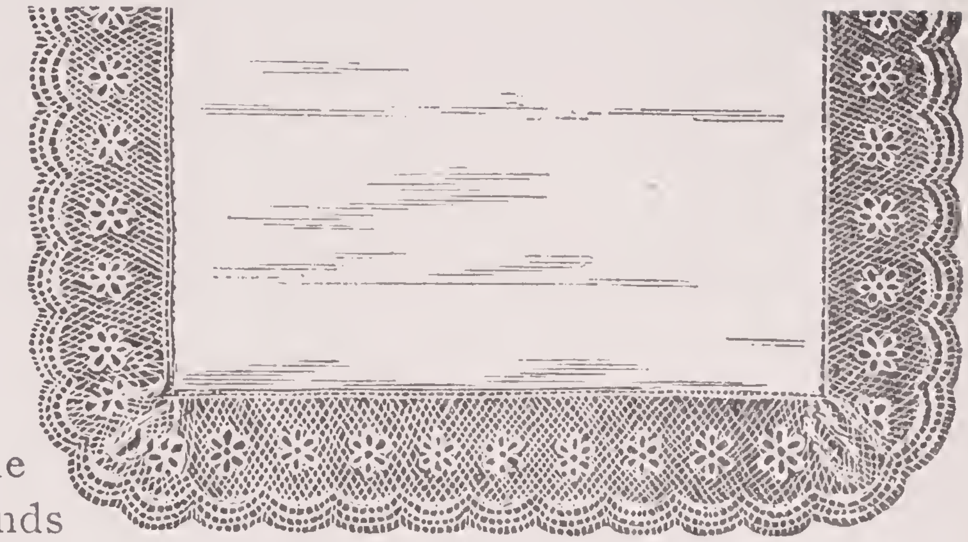
The Scalloped Edge.— After the loop stitches have been learned, the scallop, which is the first step in embroidery, can be learned and applied to simple edges in underclothing, or be done in silk and worsted for little mats.

The scallop should be well marked. It is begun at the left and worked, as the loop is worked, to the right. The stitch for this is, in reality, the blanket stitch, following a curved edge.

To Sew on Edging.— A lace edging makes a suitable finish for very many garments. It is especially good for handmade handkerchiefs, and should be put on evenly and with care.

For a handkerchief, the edging should be basted, at least until the sewer can sew evenly without that help. Put the outside of the lace to the outside of the handkerchief, leaving the edging loose. Begin to sew at one corner, using a No. 10 needle, and No. 80 cotton, or finer or coarser as the quality of the work may need. Overhand the edge

on to the linen across one side, leaving one quarter of an inch each side of the corners unsewed. At the corners, the edging must be gathered. For narrow edging allow twice its own width. For wider edges more fullness is required, so that the outer edge may not pull or loop over. Overhand the gathers around the corner, pushing them tightly together, and setting a pin to hold the right measure of the edging just at the turn. In this way go around the work to the corner where the edge began. The ends of the edging can be hemmed and felled together, or they can be rolled together, and overhanded with the closest possible stitch.



By these small niceties of form in sewing, by the stitches that man has devised and has practised for centuries, the idea of the human mind in regard to clothing has been expressed. Sewing is an intimately personal occupation, and the greater part of it is done for the shaping and decoration of garments. In its historic development, sewing has reached a perfection beyond which we do not at present look with expectation. As to that long history, we may see its starting point in the sewing materials that are treasured in our museums, pathetic in their crudeness, eloquent in their suggestion of the days when man, like a child, ignorant of all that we to-day call science, began to grope his way through the world of nature, and to find out by experience what he wanted, and what he might find the way to do.

We look into a cabinet and see a discolored fish-bone, long, thin, and sharp; we notice the small, carefully drilled hole at the end; we see hanging from it the fiber of tough grass and we realize, by this token, what must have been the little knowledge, the earnest longing, and the great delight and satisfaction of those who, in the early twilight of European history, sat in the wilderness of the north, beside their own camp and home fireside, plying their latest invention, the polished fish-bone needle. This is the opening page of needle work. When it is shown to children, in specimen or in illustration, it should be presented, not merely to touch curiosity, as something vaguely far away and odd, and not to awaken scorn or proud content, but as a sign of the whole process and history of the art of sewing — as a thing in itself good and useful, and as the beginning of the long continuance of a single industry. As the opposite to this beginning, stands the perfected steel needle of to-day, with its thread of silk, in the hand of the skilful sewer;

and also the needle of the sewing machine, where, as children should be shown, the formation of the needle is reversed in this — that the eye is set in the point of the needle instead of at the farther end — a step in thought and in process which, being invented, quickened the speed of production and lightened the labor of people all over the earth.

Interesting points in the history of sewing can be chosen and, after careful reading, can be told to children for their interest and benefit. These periods should be described in their large aspects and movements, with the date clearly defined and with the geographical location well understood.

For instance, take the thirteenth century in Europe: The arts that had arisen in Asia had then in a general way been carried into Europe, and had been taken up by the people of the new nations there as their greatest means of progress. So we read of the growth of the towns, of the rise of new industries and the better practice of old manufacture, and see how, by this use of their hands, the people worked their own way out of ignorance into the power of a greater industrial, mercantile, and commercial freedom.

As manufacture increased, new materials had to be raised and the industrial impulse spread from the towns to the lands beyond them, arousing the energy of the people and directing it to new and varied ends. With the production of new and finer textile fabrics, the art of needlework took a higher place — and so the children, here to-day ranging over the map to find these old centers of industry, from Florence, Venice, Nice, Genoa, Marseilles, to Strasburg, Vienna, and Nuremburg, to Lübeck, Cologne, Ghent, Bruges, Paris, Lyons, and all the towns that were first to rise, preceding by a little the best work of Holland and England — the children in this western home, in the twentieth century, can be set, in connection with the long story of the weaving of goods, to the cutting out and shaping of these better materials, and the final practice of swift and superior sewing.

In all true education, the teacher perceives and constantly observes the connections of things, and on this basis of a large view of life, lessons can be given to a class, or to a child at home, which in themselves are as entirely unlike as are geography and sewing, yet by the teacher's wise institution, are given as a sequence wherein one thing leads by natural development to the next.

At the time that this is being done, the child does not see the connection. To see it mentally belongs to the teacher only, but the child feels the effect of it and responds to such a course of instruction by a sense of unity with his kind, a sense that the past is his as well as the present, and by a keener intelligence in what he under-

takes to do with his own hands. This is the right culmination of all that he has been gathering. His ideas of angles, lines, and points, help him to see; his sense of companionship and achievement helps him to do — and from seeing, feeling, dreaming, and thinking, it is the end and aim of Manual Training to lead the child to a *doing* that shall be to him a sign and representation of his own power.

Sewing is given to children in schools because it belongs to man's growth along the higher degrees of existence and has proved to be an element of refinement in education. The needle is a little cylindrical tool; the thread is the means by which a design may be carried out to completion. Through practice with the very first card sewing, the child discovers that his lines run up and down, from side to side, round about through the circle and across by every possible slanting line. He works in this, in common with all humanity, finding the line possessed only of length or direction — its single dimension. He sews through and through his material, it is true, but the result of his work is on the outside — a result of outline inclosing a plane. But as a child or a class works on in the higher department of sewing, this flat linear work gives place to the production of the round — that is, to the making of clothes that are in themselves cylindrical in shape, having bodies, legs, and sleeves — the encasement of living human figures. This is the natural progress of sewing, and this is the far-off goal of every child's ambition when first she enters upon a course of sewing proper. So the industry follows human life, and in its technical development becomes an illustration of the law of growth that in all things "rests, works, and rules."

The charm of sewing as a process lies in its element of repetition. The movement along the seam is continuous for the eye, for the hands, for the needle. The line that is left behind is similar at all its points. The distance may be long, requiring many sittings, or it may be accomplished, as is best for beginners, at one lesson or sewing hour. But the motion of the stitch once taken, the muscles follow upon the model given and the pleasure of rhythmic movement becomes consciously pleasant. This comes with practice, the first pleasure to a child being the appearance of the stitch itself as a result of painstaking, and the looking forward to an end — to the knowing how and the power to do. But the rhythmic quality of sewing is peculiar, and to consider it and its effect upon a child will be a help to any one who has an observant eye for changes of mood consequent upon changes of occupation. The sewing should never be a task severely imposed. It should be so presented as to be attractive — the vital point to remember here being that the force in the child is really seeking for some form by means of which to express itself, and the

sewing, if given pleasantly, may be of service to calm a restless moment by its own character — its quality of repetition. Here, too, many times with youngest sewers, it is of use to fall into some gentle song leading to the work — a song for clean hands, a song for work, for change of work, or for work after play. Many a child's idle habits of refusal, of questioning, or of over-eagerness, can be prevented from expression, or made to be forgotten, by the quick singing of some favorite melody. The child who in a class is about to distinguish herself by tears, or by some misuse of her hands, with things or other people, can be made the leader of a song — as the kindergartner and many a mother and teacher knows. And with the sewing, many little songs, or the quoting of couplets or verses at apt moments, will touch a child's intelligence and sympathy, holding the volatile energy steady until the spirit of the occupation asserts itself and leads the power of mind and hand together along the way of industry.

In a small advanced class of sewers, or especially at home, when some proficiency has been attained, the teacher should have this question of the mental attitude of the pupils always in mind and should keep prepared for its instruction. For sewing is in itself a silent occupation. There is no sound to distract or to forbid thought or speech; there are no tools, as with woodwork, to lay down and to take up, no constant change of position, measurement, and adjustment of heavy or noisy materials. It offers periods of silence between periods of instruction and oversight, and thus, by its own character, to a degree sewing is a conversational employment. It allows and invites more or less of talk, not steadily continued, but broken by attention to the work, flowing along, a happy, open chatter, a commentary, a whisper, or even the telling of some little incident.

Here, then, natural inclination and habit offer opportunity for educational influence, and for training children in the fine art of conversation. This talking together is a mutual art, wherein all who enter are equals as to right of expression; and it is wise to set forth this principle of companionship and to establish it in all its native delightfulness at the beginning.

In a conversation, each has something to say, or will have as the time passes. Each should have opportunity to speak, and if one in a group is not by nature a talkative child, he should have all the time he needs and all the help that he can agreeably accept, by means of gentle questioning, or in brief suggestion, and in silence free from all impatience.

Conversation is an art, because it can always pass from the prosaic statement of facts to the flight of fancy and to the true imagination that lies above any subject whatever. Language is for all uses and

for all estates of life. It arises as a sign of the power of life within us, and if we observe its process, we see that it comes forth as a result of the life within in connection with the life that the child meets in nature and in society. « Language, like mathematics, has two sides; it belongs both to the inner and the outer world. Viewed in the light of the study of nature, language is an expression of energy lifted into life; viewed in the light of the study of man, it is the expression of the human mind lifted into consciousness. Language, therefore, must be born as the spirit of man enters consciousness, and is inseparably one with this spirit.»

The idea of language, as it may be used in our companionship with children, and in their association together, is, then, to help the energy of thought and of feeling that stirs within them to come forth, or, to be « lifted,» into a clear vocal sound that shall be a revelation of the spirit within. Neither the child nor we who seek to train him have any real vantage until, at its right season, this power of speech comes to our aid. When developed, it is a threefold process. Life within is the starting point; the world without is its arousing influence. The child perceives, desires, purposes, and speaks. That he should learn at once to speak well is important, and the first principle in this practice is the same with the child as it is with the man, — that he shall first have something real to say, and that he then shall have time for the utterance of his words.

It is easy to show to a class the real meaning of the word conversation. It is alternate speaking. It implies the presence of two, or of more than two, persons. It is a giving and taking — a circling round of thought and speech in a company of people. It is a social art, and as such it reveals many and diverse points of human character; selfishness and its restraint, perception quick and true, or disregard of outward objects; a natural fluency in language, or the slower grasp upon words and phrasing.

In all of this there is room for interesting study, both for the children and for whoever is leading them; and if the conversational habit is rightly allied to that of handiwork, the two can grow together toward excellence. That is, if the children are to talk while they are engaged in any of the lighter crafts, such as sewing, for instance, a conversational standard can be established at first that will gradually become a habit of mind and will be of effective service as a mental training. This can be done by setting before them, in phrase and verse and brightly-spoken sentences, the allurement of pleasant words; by leading always toward things that are positively fine, by leading away from personal remarks, by teaching that all are to help and none are to hinder, and that conversation is one of the lovely ways of using

the time, of promoting companionship, of creating joy. In this the teacher should not be dictatorial. Politeness requires listening and reply. The speakers are to be heard singly, not in chorus, except now and then when some natural exclamation calls out their voices together.

When we wish to give voice to sound in unison, we put our language into music. In that musical expression we speak the same words at the same time, fitting part to part in a regular order which all observe. This creates musical harmony. It is one means of human utterance. It is a way by which we show our love for all things — the life and beauty of nature — the love and joy, or sorrow, of our human life — our love of God.

But we talk more than we sing, and when we talk we take no measured time or form of words, but following our thoughts, phrase them as seems to us best, so that others shall know what we are thinking about. The first idea underlying conversation, then, is freedom, with consideration for the rights of each in the circle, and room for the power of each.

That there are natural rules to govern the talk of children at work is in itself an attractive idea; and since that rule is "the unchangeable third principle to which pupil and teacher are equally subject," there is nothing arbitrary in its control. It is in reality an esthetic principle, lying at the basis of common usage and having influence to redeem an hour from dullness for the teacher, while to the child it discloses a rule and a reason for conduct that can but be a stimulus, not merely in what he says, at the moment, but in his general social bearing.

It is by means of this unity of principle within, and unity of social right, that harmony is attained. If that sense of right remains, the outward expressions can be as varied as impulse may prompt, and all will go cheerfully and well.

As to subjects, they are often admirably proposed by the children. What is then required is a clear response. Also, no training in language is better for a child than simple, sincere reading of things that are well said. For instance — "You do not know what leaf-form means unless you have seen the buds burst, and the young leaves breathing low in the sunshine, and wondering at the first shower of rain." These words refer to drawing, but let a child hear them quietly read or repeated and he is at once inclined to go out and look for himself at this work of nature.

Whatever a parent or teacher can read to give impulse to real observation of nature will prove most suggestive as to language and its use for children — real observation being of course not purely for the sake of fact, but also for the sake of beauty. For instance, in

Ruskin's "Two Paths," in a few pages upon "Iron in Nature," hints are given that suggest at once the ever-present action of iron, and the charm that in common things results from its presence; and a hint so gathered may, at a happy moment, be given to a child and become a means of interest that will lead away from meaningless words to the use of good language as an expression of the growth of thought. So too, in Ruskin's "Queen of the Air," in his "Modern Painters," in his "Deucalion," and books upon flowers, may be found clear-sighted, accurate description, relating the forms of nature to human life, and offering lines of conversation, because they deal with things that children love and notice for themselves, and because they unite bare fact with beauty of every degree in nature, and are set forth in language that is in itself an educating influence.

In any social talk with children the ideal should be to draw out the native power of each in relation to a given subject, in the way of refinement of thought, perception of grace and beauty, and the happy choice of words. The talk should be a harmony free from emotion, with a good balance of heart and head, and with nothing that is either a task or a moral too pointedly put, or in any sense personal except in general ways. When this ideal is held by the mother, she will store up pleasant things to use at need, and in the drifting talk that runs along with any of the children's industries, but especially with sewing, she will elevate the tone by wise words dropped here and there on the basis of what is, with herself, a long thought and a clear one, as to all that conversation means.

It is evident that the study of any industry in its connection with children leads us as in a circle through all the steps of its development back to our starting point, which is the child himself. By any work that the child may do, in the light of modern educational thought, the idea that underlies the occupation is that the process makes manifest the law of the work, and that by its practice both the child's mind and his body get a training that helps his general development of power. To keep this clearly in mind is to relieve the teacher from the sense of restriction and drudgery, for refreshment lies in the comprehension that in education we deal primarily not with facts and things, but with life itself. And life comes eager to seize everything that offers as a means for representing itself "externally" along the lines of its threefold relationship,— the natural, visible things of the earth, the invisible power of the divine, which is purely spiritual, and the things of human life,— the plane of human being where all activities culminate.

"Man is developed and cultured not only by what he receives and absorbs from without, but much more by what he puts out, and

unfolds from himself." In order that the force of life may put itself forth in those directions that in the return and reaction of energy will enable them to bring the best back as their harvest, we should surround the child, while he is at work, with everything that is fine and elevating. The sewing hour should be made charming with tidy dressing, with flowers, potted or cut, with a book or two at hand out of which some one may read a verse or a little story, and, above all things, the atmosphere should be kept equable and clear, without strain, and without direct teaching. Incidental remark goes a long way to touch a child's sensibility, and the sewing hour may be to a teacher, or to the mother at home, an opportunity for wise dropping of seeds of thought that will have influence upon character, and lead in time to that high and clear representation of mind and heart that is our constant ideal.

To this end we must ever remember that what we are doing is a part of the universal life. As Froebel says: "This is the first general presentation of the great laws and tendencies of nature — to represent each thing in unity, individuality, and diversity, to generalize the most particular, and to represent the most general in the most particular; and lastly, to make the internal external, the external internal, and to represent both in harmony and union.

"If, at the same time, we keep in mind that man, too, is almost wholly subject to these great laws, that almost all the phenomena and events of his life are based on them, these considerations will reveal to us also the nature of man, and teach us how to develop and educate him in accordance with the laws of nature and of his being."

# MODELING IN CLAY

Clay is one of the best mediums we have for imparting a knowledge of form, because in modeling it we deal with solids and not with planes, and in using it as a mode of expression the sense of touch is highly developed. The most beautiful curves which the sculptor molds are produced by the fingers, and their delicate variations are sometimes perceptible to the touch more quickly than to the eye. Clay modeling employs both hands — an important thing from an educational and physical point of view. It may be so linked with nature study, in the reproduction of forms of fruit, fish, butterflies, and other objects, that the pupil will have greater interest in both lines of work. It also increases the sense of power in the modeler, as he finds himself able to reproduce his finest ideals in so plastic a medium. It quickens the faculty of observation and as an aid to memory it is invaluable.

For example, suppose a dog is to be modeled from memory. In his first attempt the pupil may produce a gross caricature of the animal, but he will know that it is incorrect, and when he next sees the living animal, he will note with care its proportions, its lines, and its natural poise. On repeating his attempt to reproduce the dog in clay, he will draw on his memory for a faithful picture of the dog, and come nearer to success.

## THE PLANT

The plant needed for clay modeling is simple and inexpensive. A table with a smooth top, twenty inches wide, and at least thirty inches long, will be needed, and should have a strip at the back, so that the clay will not be pushed off and litter the floor. A hinged back, which may be fixed at any desired angle, for holding drawings or models, is a useful accessory. The tools include a palette-knife, with which to cut and smooth the clay, and one or two wooden modeling-knives such as are sold by kindergarten supply stores.

Ruler, triangle, and compasses, will be needed in measuring some kinds of work. A small watering-pot, for moistening the clay,

completes the outfit. Drawings and models may be supplied as needed.

There are several kinds of clay,— red, yellow, blue, and gray. The gray clay is preferable. It may be obtained from a pottery, where ten or fifteen pounds will cost only twenty-five or thirty cents. If no pottery is accessible, clay of fine grade may be purchased at an art store, where the price will be higher — four or five cents a pound.

A wooden box in which to keep the clay must be provided. Clay cleaves from wood but adheres closely to metal or porcelain, and boxes lined with either of these substances should not be used. When not in use, the clay should be covered with a piece of thick, woolen cloth, which will serve to keep it moist. If the clay is not to be used for some time, it should be exposed to the air and allowed to dry, which will keep it "sweet" and do away with any musty odor. When it is again needed, water may be added and the whole mass moistened and kneaded to the proper consistency.

There is no reason why clay-modeling should "make a mess," either on the floor or on the clothing. The lump of clay should be kept on one corner of the board, and portions cut off only as they are needed for immediate use. Scraps and shavings should be kneaded into the original lump. The work may be done even in the library or the sitting-room, and should not "make dirt" to trouble the housekeeper. A care for neatness in the beginning will prevent litter, and will contribute to the educational value of the work.

The first models will be crude and not worth keeping. They may be thrown into the clay-box and worked into the general mass of clay with a small wooden spade. This may be quickly fashioned from a shingle. The working over of dry clay will call for the vigorous use of an iron shovel. In this way the original purchase of clay may be made to serve as material during many lessons, for it can be used over and over.

## MANIPULATING THE CLAY

Before beginning to model forms, it is desirable for the learner to understand, in a general way, the properties of clay. Unless the clay is of the right consistency, it cannot be easily modeled. If it is too stiff, it will crumble and break and cannot be readily made to take the desired shape; in this case it must be moistened by applying a very little water at a time and kneading the clay until the water has been distributed throughout the lump, making it of even consistency. On the other hand, if the clay is too wet, it will not retain

its shape and will be too sticky. It must be dried a little before it is used.

Take a piece of clay as large as a hen's egg and roll it between the palms of the hand, as you would roll molasses candy, until it is about as thick as your finger throughout its length. Hold it up and you will see that it is as limp as putty. But if you pinch it so as to make it hold together more firmly, it becomes quite stiff and will stand alone. This pinching is what the potter calls "wedging." In modeling it is necessary to constantly pinch or "wedge" the clay so that it will retain the shape you give it.

Take the same piece of clay and roll it briskly on the board. Squeeze it in the hand and then roll it out again. The clay does not hold together, but breaks and crumbles. The potter would say that it is "rotten"; that is, it has lost its elasticity and in this condition it cannot be used for modeling. But if you moisten it and knead it thoroughly, it will resume its former pliable state and be ready for use. This is called "tempering" the clay.

## ELEMENTARY FORMS

The first forms modeled should be simple ones, chosen with a view to giving the pupil familiarity with the manipulation of clay, rather than with reference to the modeling of form, a sense of which is, nevertheless, quickly developed, even by preliminary exercises. A ring is a good form for practice. Take a small piece of clay and roll it in the palms of the hands until it is three or four inches long, and half an inch in diameter. Join the ends and manipulate the clay so that the joint will not show. Take pains to make the ring of even thickness, and smooth throughout. Another ring may be made and linked to the first, and then a third, thus forming a chain.

Fig. 1

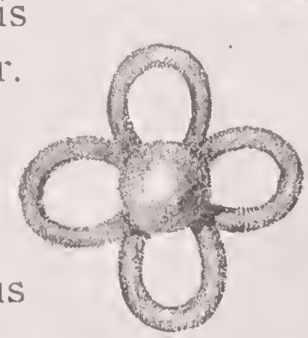


Fig. 2

The sphere will naturally suggest itself as a good form. It will be difficult to make a perfect sphere unless the clay is of the right consistency, and it should be brought to this consistency before the form is laid aside, in order that another may be taken up. Small balls, about the size of marbles, may be rolled out and piled in pyramids, like the mounds of cannon-balls at a fort.

A leaf may be easily made. Shape a small piece of clay between the palms until it resembles an arrowhead. Then, holding it between

Fig. 3

the thumbs and forefingers, press it thin and at the same time give it the form of a leaf. A tiny ridge down the center will be the mid-rib, and the veins may be indicated on either side. The edge should be notched and the stem fashioned as nearly as possible like the natural leaf. All this may be done by pressure of the thumbs and fingers, and without implements. A walnut, with its sharp-pointed end; a chestnut, with sloping sides; an egg, a turnip, a carrot, are some of the forms that may be easily made in this way. Five of the leaves thus made may be joined by the stems, and a half sphere added at the center so as to form a rosette.

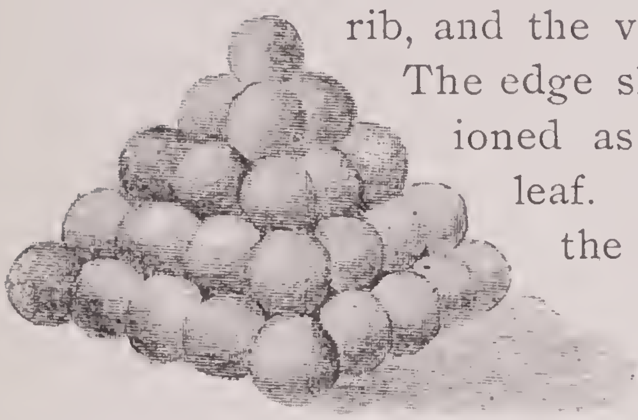


Fig. 4

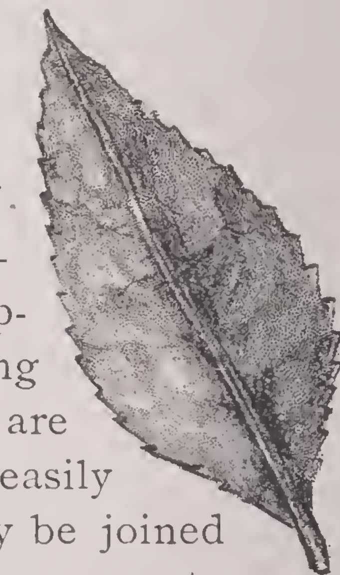


Fig. 5

It is suggested that the forms of fruit, vegetables, etc., first attempted, should be those which can readily be reproduced in the natural size. For example, the first egg modeled in clay from memory will probably be larger or smaller than the average real egg. After a clay egg has been made, it may be compared with the real one and the difference in size noted. This helps to train both observation and memory, two faculties which clay modeling stimulates in a large degree. Miniature forms should not be made when it is practicable to reproduce the model in its natural size.

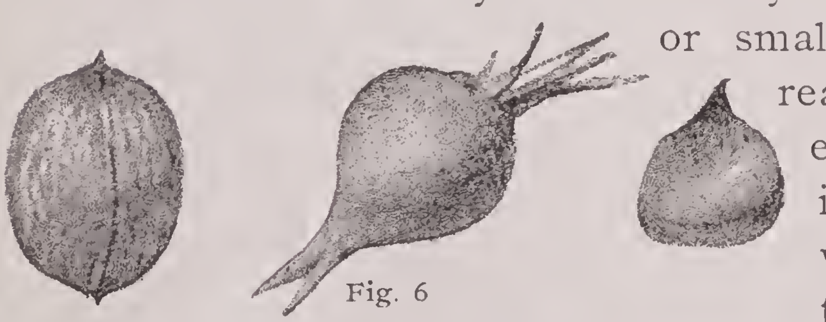


Fig. 6

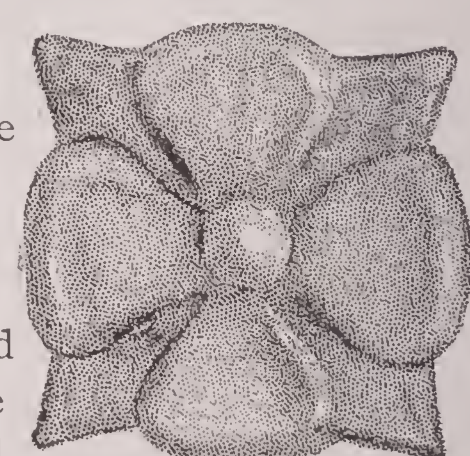


Fig. 7

Children always manifest great interest in the modeling of animal forms, and the pupil should be encouraged to make them from memory. For example, a dog may be modeled. A piece of clay as large as the fist may be rolled out, then flattened at the sides, for the body. A small ball will serve for the head, and the snout should be given shape, while the neck is made thinner than the head. Small pieces

of clay may be modeled to represent the tail and the legs. The figure produced at the first attempt may not resemble a dog very strongly, but that does not matter. The pupil can make another, and the second will surely show an improvement over the first. A chicken, a cat, a lamb, a pig, may be modeled in like manner.

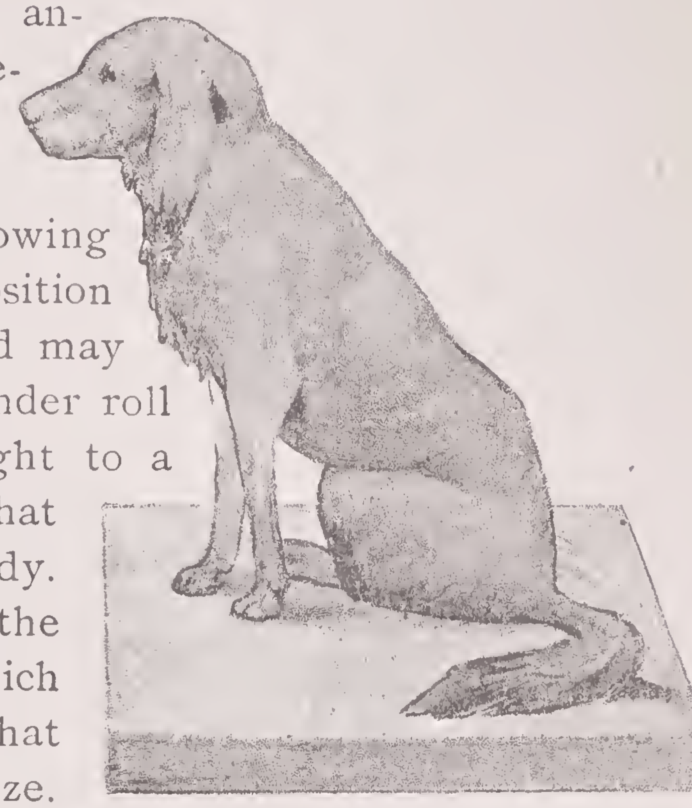


Fig. 8

A frog is not an easy form for a beginner, owing to the difficulty of representing properly the position of the legs; a snake is simpler, and may be made without difficulty. A slender roll of clay is made, the tail is brought to a point, and the head is flattened so that it is a little wider than the body. With the tool make the eyes, the mouth, and the tongue, which will necessarily be somewhat exaggerated in size. The snake may be curved in a wavy line, as if moving through the grass, or coiled, with the tail projecting and the head raised in the attitude of defense.

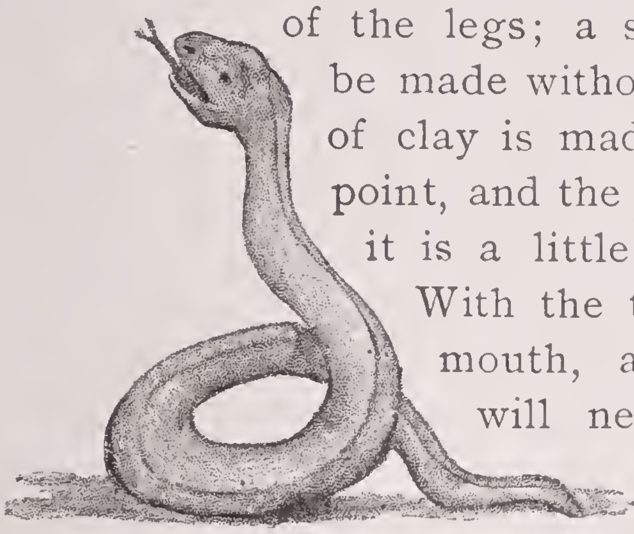


Fig. 9

A mouse is another form that may be easily made. The body is made from one piece of clay. The legs and feet are pinched to the proper shape and a long slender tail is made, and these are stuck on. Two bits of clay are added in the proper position for the ears, and the ears, eyes, and mouth are then shaped with the tool.

A squirrel sitting on its haunches is a good subject. The hind legs should be rolled out and pressed into shape, and incorporated with the body; then the fore legs, with the paws raised, and holding a nut. Making the long bushy tail curve gracefully up and away from the body will test the sense of form already possessed by the modeler.

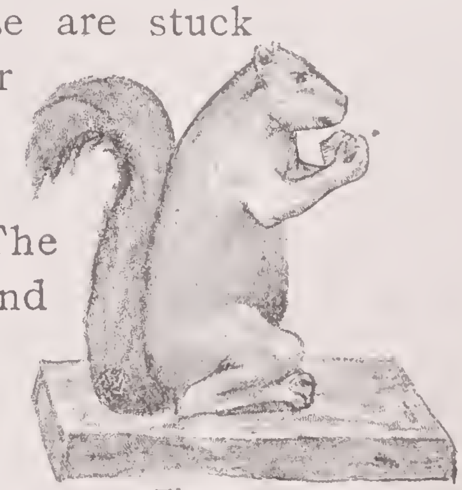


Fig. 10

All these forms from life are instructive and pleasing to the modeler, and, although the first figures produced are often so crude that they are not worth preserving, the practice afforded is excellent.

## HOLLOW FORMS

The making of hollow forms is an interesting phase of modeling. A cup will naturally suggest itself as one of the first of these forms to be made. Take a solid piece of clay, an inch and a half in

diameter, and press the thumbs down into it. Spread it out little by little, turning it round from time to time, and try to secure an even thickness by manipulation with the thumbs and fingers. Do not try to make it too thin. The clay will have a tendency to spread out from the top and must be "wedged" and restored to the proper position. The sides should curve gently toward the bottom. Flatten the base on the board, and then pinch the edge of the base into the form of a rim. For the handle roll out a slender piece of clay and mold the ends into the side of the cup, giving the loop a graceful bend. A small pitcher, flattened at the sides, is another good form. The rim may be drawn out to form a lip. The pitcher should not have too narrow a top, which would prevent easy manipulation with the fingers on the inner side. In making such forms as have been suggested, the worker will need to remember that, wherever it is necessary to attach legs to an animal's body, or the handle to a tea-cup, the joint must be made by manipulating the clay at that point so that the two pieces will be thoroughly incorporated with each other; if the small and slender pieces are merely pressed into place, they will drop off when the clay dries.

Fig. 11

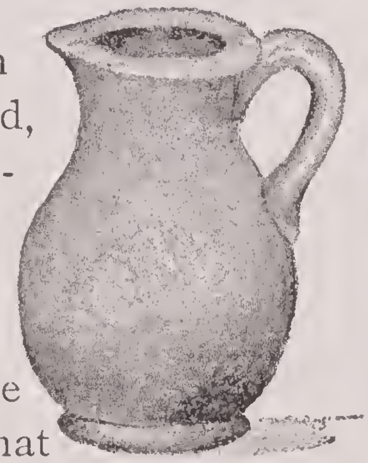


Fig. 12

Fig. 13

TILES

Fig. 14

The modeling of tiles in design is not so interesting to a young child as the making of forms from nature, in the round, but it affords excellent practice, and the making of simple tiles and borders should form a part of an elementary course.

To make a tile, take a piece of clay and press it flat on the board. Then add another piece and join the two thoroughly. Keep on adding pieces in this way, until you have a flat piece large enough for the proposed tile. Make it flat on both sides

by pressing first one side and then the other against the board, and have it of even thickness throughout. Then transfer it to the slate. With the end of the knife cut the clay to a rectangular form. A pattern may now be drawn on the tile and then pricked with a wooden point, as in Figure 15. A more elaborate design is shown in Figure 16. Here the outline is pricked and the rosettes are embellished wtih bosses, which are separate bits of clay added to the tile and then pricked. Animal and fruit forms may be mounted on simple tiles and preserved in this way.

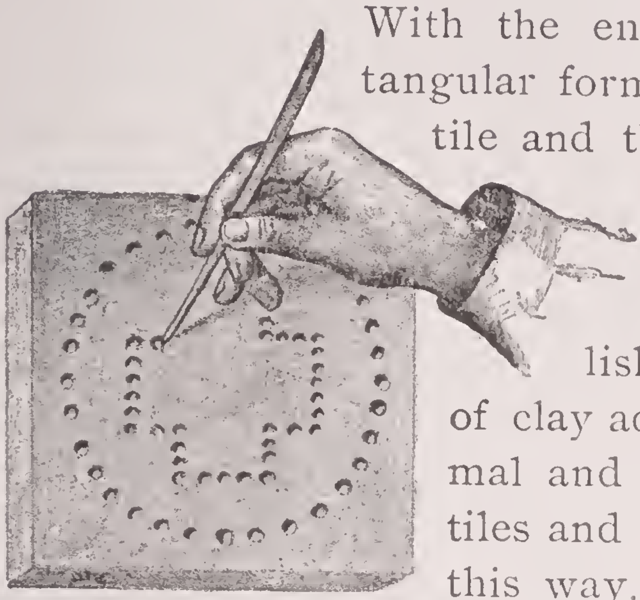


Fig. 15

The exercises suggested up to this time are merely introductory, and are intended chiefly to familiarize the pupil with the possibilities of modeling and the actual manipulation of clay, and to make the work so interesting that he will be enthusiastic in his desire to take up advanced work. These simple forms are not only suitable for modeling by young children, but should be selected as the first to be attempted by older hands. Manual Training, of which clay modeling is a feature, seeks not only to impart information but to create interest in the work done, as a sure means of generating ideas. The modeling of geometric forms, which has its place in advanced work, is essential in teaching accuracy, but, in creating interest, is not to be compared with the modeling of natural forms; hence the preference given to the latter in a course for beginners.

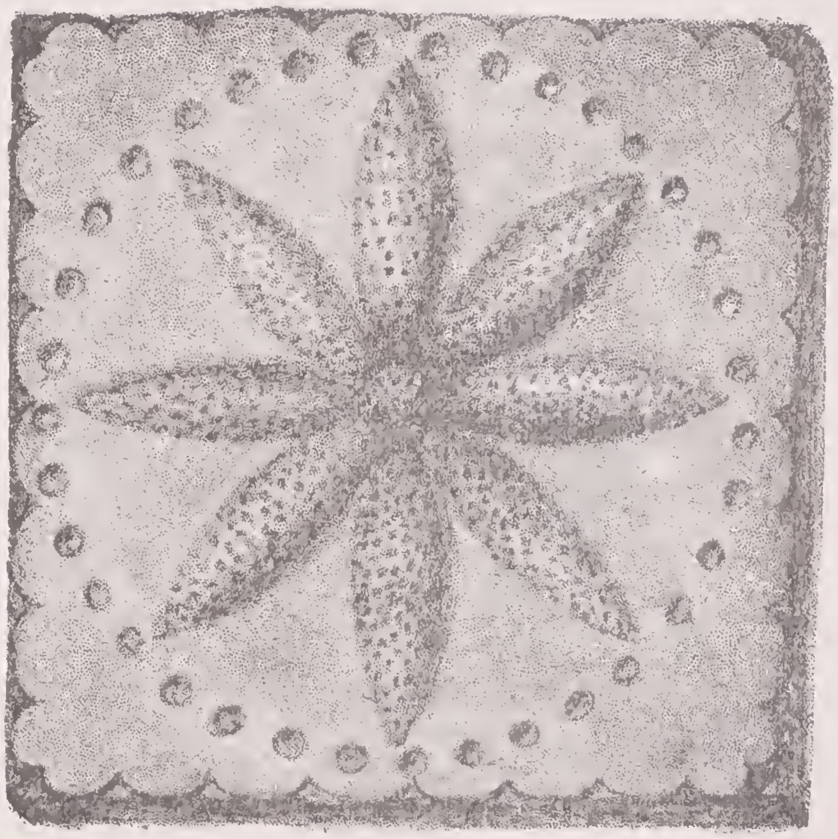


Fig. 16

## CLAY MODELING AS AN AID TO NATURE STUDY

One of the advantages derived from clay modeling is the opportunity it affords for combining the actual work in clay with nature study. Instructors in modeling often lay too great stress upon the imitation of approved objects of art, and set children to modeling from casts of famous sculptures. Undoubtedly these forms are both beautiful and worthy of reproduction, but to the young mind, the armless Venus of Milo is less interesting than a living animal or a

fruit; it is farther away from the sphere in which the child's mind is accustomed to dwell. Besides, it is the work of a great sculptor, who understands those principles of art of which the child has, as yet, no conception. The apple, on the contrary, appeals at once to his understanding. If he undertakes to reproduce the Venus of Milo in clay, he will fail, and recognize the failure, which dampens enthusiasm and may lead to positive disgust; but to model the familiar apple seems much easier, and on that account, the work will be easier, since it is undertaken with confidence in the result. The clay model of the Venus of Milo can never be more than a feeble imitation of the wonderful marble made by another modeler; but this especial apple is now to be modeled for the first time; the work is, therefore, original. No one ever saw a child who did not look doubtfully at the Venus of Milo, wondering why the statue should be called beautiful, since it has no arms. The child mind demands completeness. An "art atmosphere" is often considered to be essential, but we are not now trying to produce artists, but rather to develop ideas and impart general education.

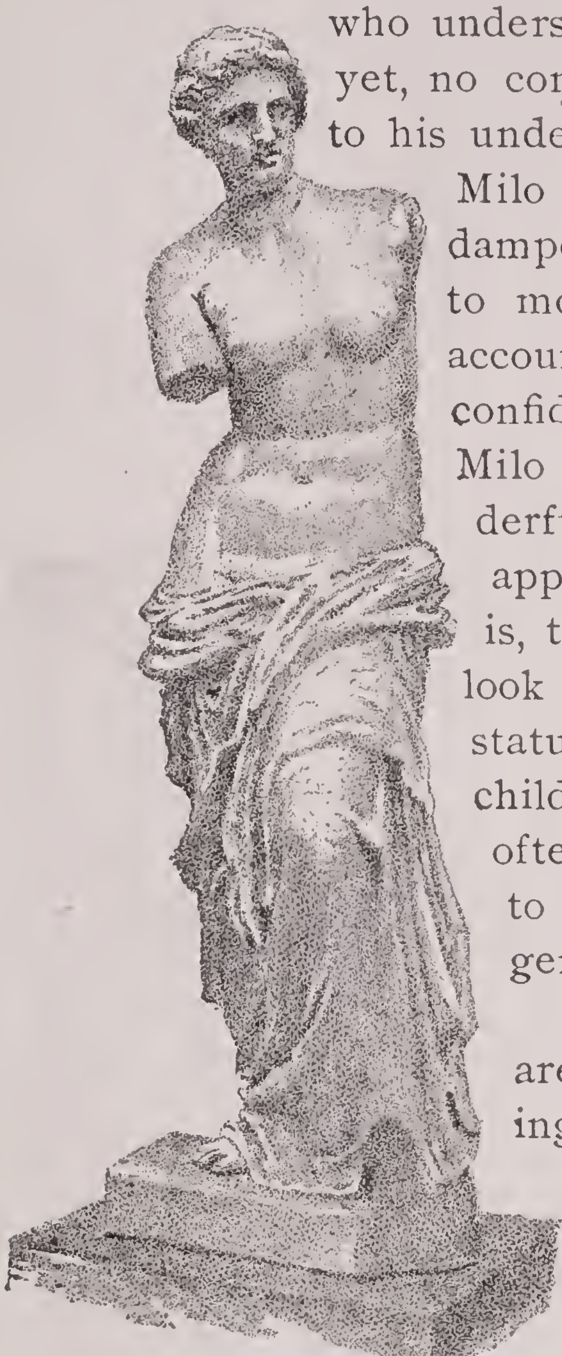


Fig. 17


Fig. 18

Fruit, vegetable, and animal forms are therefore recommended for modeling, and real apples, turnips, and potatoes, should be first provided. While their colors cannot be reproduced in the clay, the model is more interesting because they appear in it, and from closely observing the real fruit, much more is learned concerning it than when use is made of a clay or marble model of the same subject.

Any model from nature will suggest a line of supplementary study. For example, if a peach is being modeled, the structure and growth of the fruit should be understood — how the stone is planted to produce the tree, in what climates peaches are most successfully grown, the extent of the market, etc. So with any natural model, some knowledge of its part in the scheme of nature should be gained. Take for a model a beet. What about its seeds? Do they come from within the beet, as in the case of the apple, or from the plant? Of what size, form, and color are they? How planted and cultivated? In what forms does the beet furnish us with food? What great industry has been affected

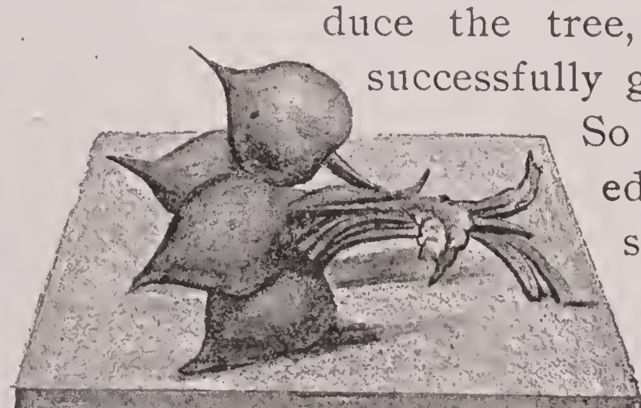


Fig. 19

by the extensive cultivation of the beet? People who decry Manual Training as dealing with non-essentials are answered in the broad general knowledge acquired by the pupil who deals with models as real things, to be intimately known and understood, and modeled in clay or carved in wood as a means of expressing the knowledge acquired.

An apple may be had for a model at any time in the year. Model an apple. Take a piece of clay and give it, roughly, the desired shape. Now take the tool and form the sides, following the lines of the model and not attempting to idealize it. If the apple is slightly flatter on one side than on the other, model it so; but no very eccentric form should be selected as a model; it is better to have an average fruit. The correct form is imparted to the clay by shaping with the tool, which should all the time press the clay into greater compactness, but without scraping it. If there is a little wen on the apple, dab on a bit of clay at the proper spot and model it with the tool. The hollowing out of the stem and blossom ends may be done with the tool. A bit of clay is then modeled like the stem and inserted in the proper position. It should be as nearly as possible like the original, in form, but it is a mistake to insert the stem of the real apple in the clay. This makes the work grotesque and unnatural. The work in clay may be so well done as to be worth keeping, but the natural stem will wither and drop out. To omit the modeling of the stem in clay and use a real one instead, is to suggest the slighting of the work, since the stem is a part of the form to be modeled, and should not be borrowed. The model should not only be looked at, but should be taken in the hands, turned over and over and felt. Clay modeling seeks to develop the sense of touch and the outlines of the real fruit should be felt as well as seen.

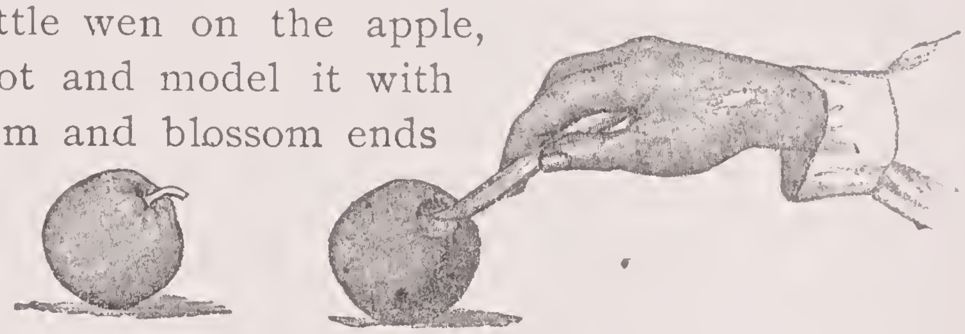


Fig. 20

An orange may be modeled, and the little indentations on the surface indicated by pricking, care being taken not to prick too deep. A lemon is another good form, and the banana, which is more difficult, affords excellent practice. The clay should be rolled to nearly the proper size, and then the flat or slightly rounding sides of the banana, four, or sometimes five, in number, should be formed by drawing the tool from one end to the other. One end must be curved. The other tapers to a blunt point. The angles formed by the sides of the banana should not be too sharp. The thick, rough stem should be carefully modeled with the tool. Attention must be given to the consistency of the clay, which must be rather stiff, so that the banana will keep its slight, but characteristic, curve.

Among the vegetables, also, there are most interesting models. The common potato, the sweet potato, the carrot, the beet, the cucumber, the tomato, and the radish are good forms. In modeling the potato, the eyes may be made with the tool and the reproduction of the uneven surface should be carefully molded with the fingers. Make a carrot, and take pains to give the clay the form of a carrot, not that of a parsnip. The distinction should be clearly made. It will be a good plan to first study the carrot, the parsnip, and the radish, side by side, noting carefully their differences. Model one form, and then follow with the others. It should be easy for a critic to distinguish the several forms in the clay without hesitation. A bunch of asparagus offers an excellent model. Each stalk is made by itself. The clay is rolled to the proper thickness and the head is then carefully formed with the tool. The second stalk may be placed beside the first, as soon as completed, and incorporated with it at the lower end. When all the stalks have been assembled in this way, clay should be added around the bunch and the string modeled with the tool.

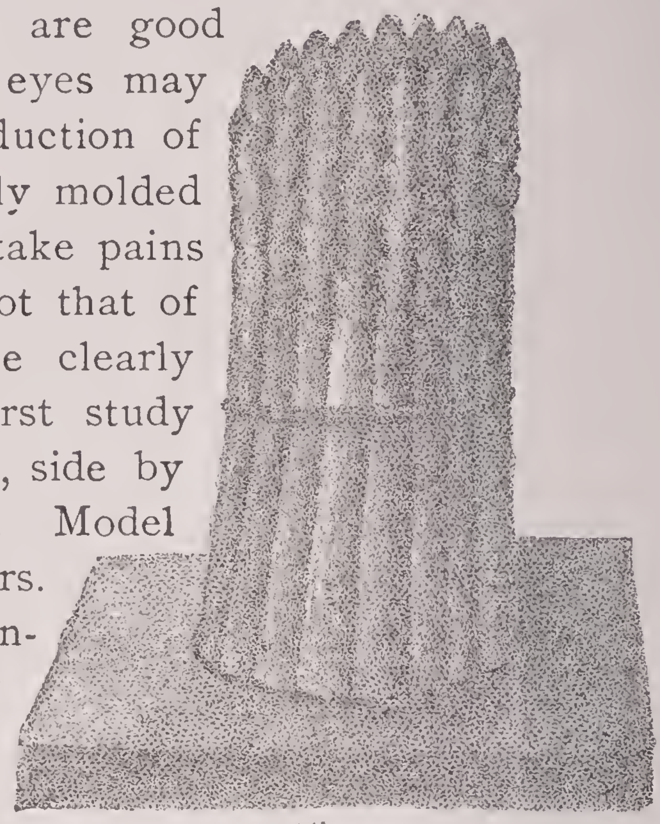


Fig. 21

Fruit and vegetable tiles are interesting forms, and afford excellent practice. Shape a tile about five inches wide and ten inches long. Give it the proper thickness, but do not trim it until the fruit has been added, as the edge will probably be marred and must then be trimmed again. If possible, have for a model a branch of a tree, from which the fruit has not been removed. A piece of grape-vine, with two or three of the broad leaves, and a bunch of grapes hanging from the vine, is a good model. Model the bunch of grapes, building up from the side that rests on the tile. Then roll out a piece of clay and with the tool give it the rough texture

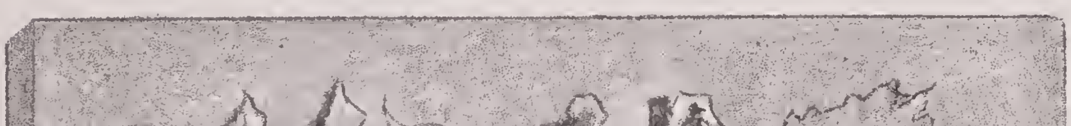


Fig. 22

of the grape-vine. Place it in position and attach the stem of the bunch of grapes to the branch. Three or four of the broad leaves may then be modeled and attached to the main stem, and to the auxiliary branches which may be added to the tile. Figure 19 will give an idea of the composition. Of course, the clay leaves cannot be made as thin as the real ones, but if the edges are made thin and the under part of the leaf is made thick, the effect is natural. It is surprising to see how the appearance of thinness can be imparted in this way. One or two trials will make it plain. The leaves should be modeled with the fingers, as was done in the elementary course, and the veins may be plainly indicated by the same means. Curve the end of the leaf outward. If necessary, sufficient clay may be placed beneath the leaf to support it. It is useless to attempt to make clay leaves or stems as thin as the natural model.

Have the grapes as smooth and rounded as possible, but do not attempt to give the leaves more smoothness than comes from the modeling with the hands. Let the face of the tile show the marks of the tool. They give it a more picturesque appearance than if it were carefully smoothed. When the fruit has been successfully modeled, trim the edges of the tile with the knife.

In making a tile of this kind, do not try to raise the fruit and leaves too far above the surface of the tile. The bunch of grapes need not rest upon a single row of grapes, but may rest upon two or three rows. The loss of symmetry is inconsiderable, so long as the tapering end of the bunch is well formed. The stems and branches will require careful modeling with the tool, when they are incorporated with the clay on the tile.

A vegetable tile showing the beet and its broad leaves, is a good study. The beet-top may be very accurately represented, as the leaf-stalks are thick. The leaves of the carrot and the potato are more difficult to make and need not be attempted in the early stages of the work. Indian corn, however, is an excellent subject for modeling, and the long, narrow leaves and the thick stalk are easily formed. The corn silk may be represented with some degree of success by careful work with the tool on clay raised a little above the surface of the tile. The modeling of the kernel of corn on the ear will call for equally careful work with the tool.

Fig. 23

These suggestions are but a few of hundreds that might be made. The modeler should not be confined, in practice work, to reduplication of the same form, nor even to one class of subjects.

When the bunch of asparagus has been well made, it is much better to take up the carrot, than to make another bunch of asparagus; and the vegetable model may give place to fruit forms for a time.

## GEOMETRIC FORMS

Modeling geometric forms is apt to become quickly tiresome to children. As they see neither prisms nor cubes outside of the schoolroom, they cannot fail to wonder "what they are for," and as the production of mere abstract forms seems useless, they cannot reach the same degree of interest in modeling them that they find in modeling forms from nature. It must not be supposed, however, that clay modeling is intended to furnish amusement first and education afterward.

While it is a safe principle in education that the more entertaining the work can be made, without departing from correct lines of instruction, the surer will it be to bear fruit, the merely pleasing features should not be exaggerated at the expense of the less pleasing, but should be equally instructive.

It is desirable, therefore, to undertake some work in modeling geometric forms. This work involves in a high degree, accuracy and attention to proportion. Little children should not be compelled to model cubes, prisms, and cylinders, too often nor too long at a time. Older learners may profitably devote to such work a reasonable part of the time for modeling, but even they will do well to change frequently to the natural forms.

The sphere, the cube, the cylinder, the cone, and the prism, are suggested for the study of the geometric forms. They should not be attempted on too large a scale. A size suited to the grasp of small hands should be chosen. Wooden models may be obtained from dealers in school supplies, and are inexpensive. Do not invest in a large variety of these models. Beyond the amount necessary to purchase the five forms mentioned, the money may be better spent on natural models and a few good casts.

In modeling these forms, the aim should be to reproduce them in exact counterpart in clay. The height should be the same, the angles the same,— all measurements on the original should be duplicated in the clay. The purpose now is to teach accuracy. A plane should be quickly distinguished from an uneven surface, a right angle from one of eighty-eight degrees.

Make a Sphere.— Roll a piece of clay in the hands, turning it constantly; rub away the hills and fill up the hollows, using no tools

except the hands, and when it has been made as nearly spherical as possible, place it beside the model. See if the diameter is the same in the clay as in the wood. Test it with the dividers. If the clay does not form a true sphere of the proper size, add more clay and roll it again. Of course it is not to be thought that a perfect sphere can be made in this way, but perfection can be nearly approached.

Fig. 24

To model a cube, take a piece of clay of nearly the proper size, and tap one side on the board until it is plane. Turn it over and tap the opposite side until that is also plane. See if the planes are parallel to each other. Set the clay beside the model and observe the height. If it is too high, rub away some of the clay with the fingers, and repeat the tapping. If it is too low, add more clay. Having made two sides plane, turn the clay on end and tap another face to a plane, which is perpendicular to the two previously made. Again test the height. In the same way tap the remaining three sides of the clay to planes perpendicular to the adjacent plane and parallel to the opposite sides. At every step the clay should be compared with the wooden model. The tapping should be carefully done, and the corners made clean and sharp. The completed

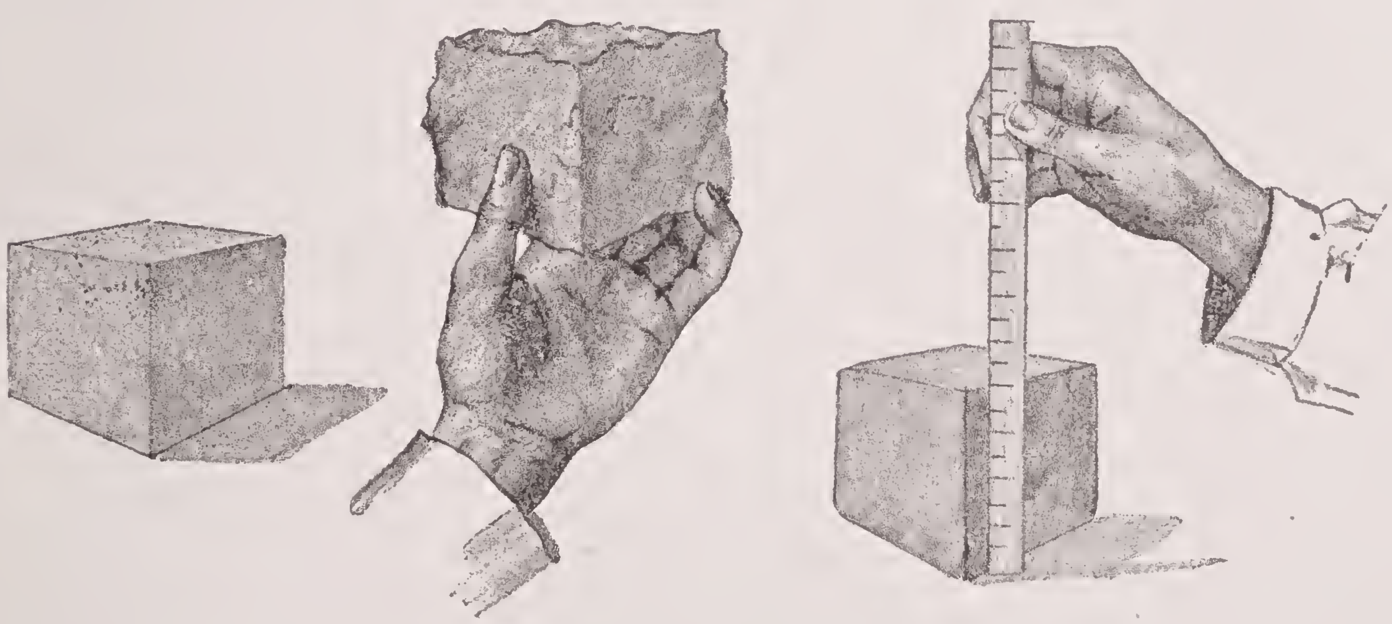


Fig. 25

cube should be measured and the measurements compared with the wooden model. Do not measure with the rule during the progress of the work, but try to produce six planes equal to each other and to those of the model, by judging with the eye. This compels attention and gives the eye power to measure distances accurately.

In making the cylinder, the methods of making the sphere and the cube are combined. Roll a piece of clay between the palms,—

not on the board,—and tap the ends to produce planes. The ends should present equal circles.

Fig. 26

The cone is made by rolling it first in the hands and then on the board. Notice the angle at which the sides slope from the base, and roll the clay about a central point. The base must frequently be tapped.

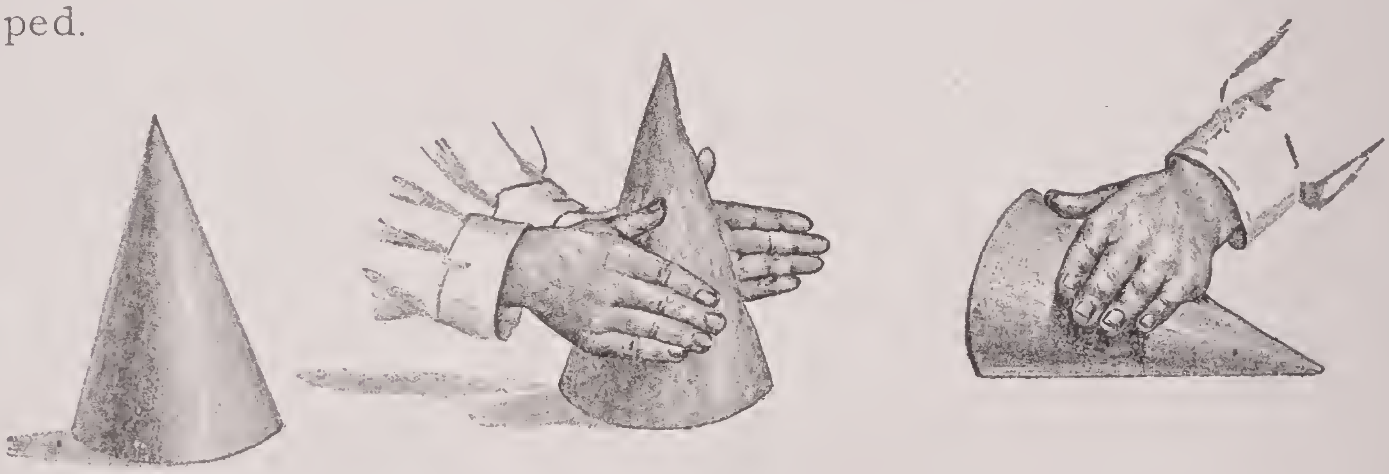


Fig. 27

The prism may be made by tapping the cone until the four plane sides have been formed.

Fig. 28

Each of these forms should be repeated three or four times and the several results compared, each with the others and with the wooden model. But do not work on them until they become tiresome.

## CONVENTIONAL FORMS—TILES AND BORDERS

THE modeling of conventional leaf forms, scrolls, and the like, on tiles, affords good practice in forming curves, which must constantly be used in modeling natural objects. The preliminary work is not particularly interesting, but it should not be slighted, and when sufficient practice has been had, the opportunity to develop original ideas in modeling tiles and borders is large.

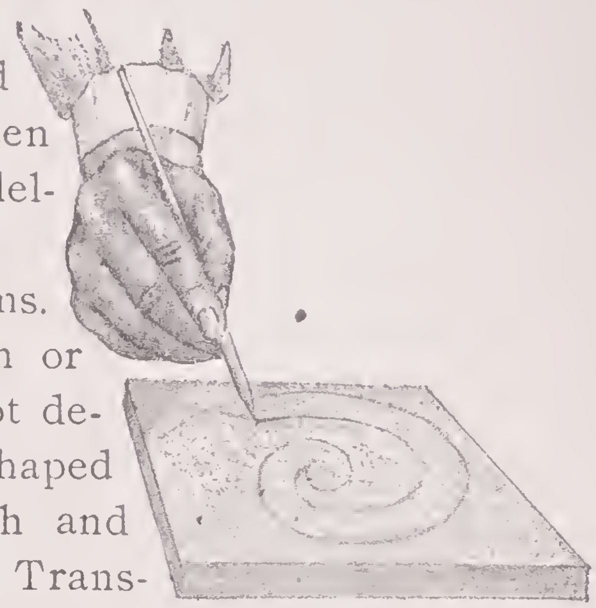


Fig. 29

The work begins with the making of scroll forms. A tile should first be made, three-quarters of an inch or an inch in thickness, and ten inches square. It is not desirable to make smaller ones. This tile may be shaped with the hands and built up to the desired breadth and thickness by the addition of successive pieces of clay. Transfer the tile from the board to the slate, where there will be no danger of its sticking. On the surface of the clay, draw the design with the point of the tool. This should be done free-hand. As often as the drawing is unsatisfactory, it may be obliterated by working the face of the clay with the fingers. Draw the scroll so that it will fill the space on the tile, and make it as graceful as you can. When the drawing has been satisfactorily made, roll out pieces of clay and incorporate them with the tile, on the lines of the scroll. Build up the scroll piece by piece, in this way, until it has been roughly formed throughout.

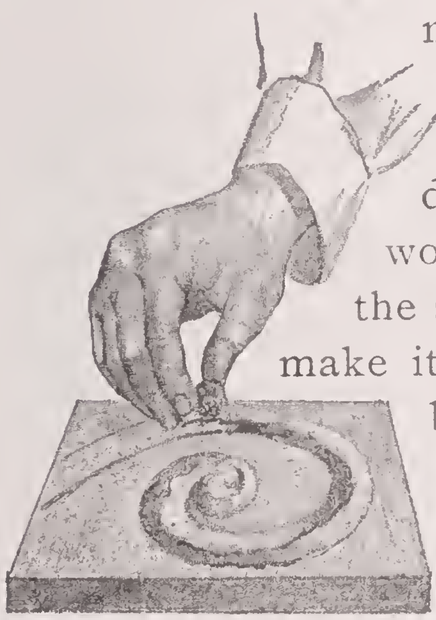


Fig. 30

Now comes the shaping of the curve, which is more difficult than it looks. The tool should be swung freely around the curve, with a long, steady sweep. Do not try to make the curve with short, jerky strokes. The tool should be held in both hands, as shown in Figure 31. You should try to make the curve with a single sweep. This will not be easy, but as you persist in the effort, you will acquire greater manual dexterity, and you will see that the longer the swing of the tool, the more perfect will the curve be. The forming of the curve will bring the scroll to a sharp angle at the top, and the line so formed should be even and not wavy. When the curve is satisfactory, trim the edge of the scroll down to the face of the tile

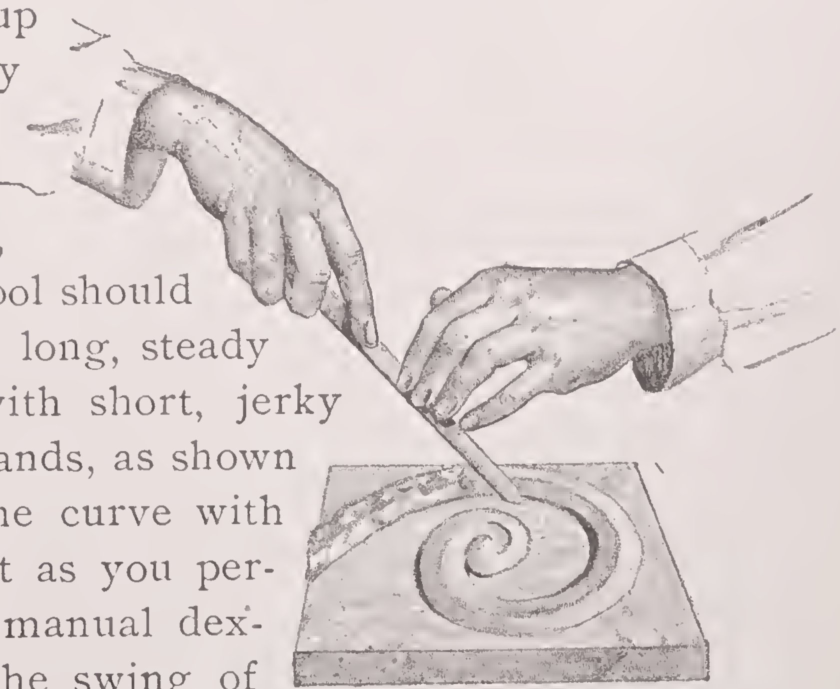


Fig. 31

with vertical cuts. There is no absorbing interest to be developed in making the scroll, but it affords such excellent practice in swinging curves and developing a greater dexterity of the hand that it is worth while to spend hours of patient effort upon it, if need be, until the work becomes easy.

Fig. 32

The scroll with crockets, Figure 32, may be made as an advanced exercise. The drawing should be made in the same way as before. Take time to draw it well. Then build up the scroll with clay, and shape the curves and tips first with the fingers, then with the tool. At the inner angle between the crocket and the scroll take pains to form a clean junction. The inner curve of the scroll is to be concave and the outer curve convex; hence the concave curve of the crockets will meet the convex curve of the scroll, and the convex curve of one crocket must be made to diminish into the concave curve of the scroll, without showing a line of junction.

A tile may be made, ornamented with a three-pointed-leaf form. The latter should be modeled with the hands and incorporated with the tile. The tool is then employed for modeling the surface of the leaf, first the midrib, then the side-ribs and veins. The edge of the leaf should curve upward from the tile and be made thin.

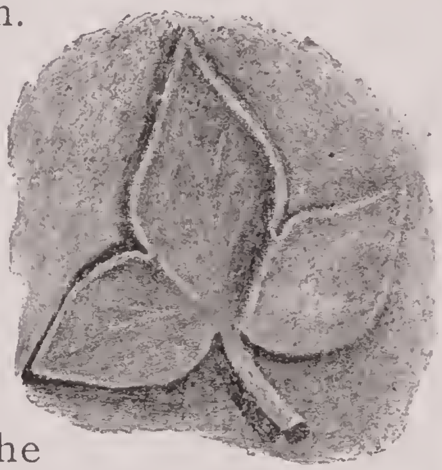


Fig. 33

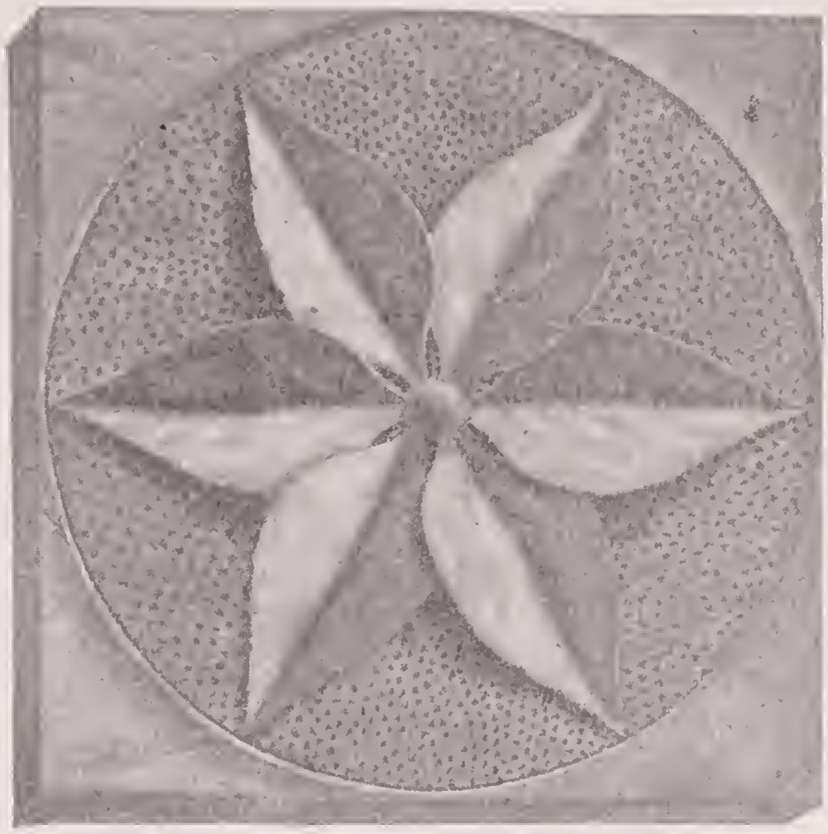
Fig. 34

The leaf and scroll forms may now be combined in a variety of exercises. Add one lobe of the leaf to a double scroll, as in Figure 34, or shape the leaf itself into a scroll form, as in Figure 35.

To make a rosette which shall cover the face of a tile, draw the design on the clay, varying it, if you choose, from Figure 36, which is suggested as one good form to make. Begin to build up the form at the center, by making the boss roughly. Then shape the five large leaf forms in the hands and add them to the tile, centering the stems at the boss. Let the leaves overlap each other. Finally, model with the tool. Make the pieces look like leaves,

not like slices of bark. Model carefully, and do not be satisfied if the work comes merely to the point of suggesting leaves. During the progress of the work, the po-

Fig. 35



36

sition of the tile with reference to the modeler should not be changed. It will not be altogether easy to model the leaves farthest away and that is the very reason why they should be made without

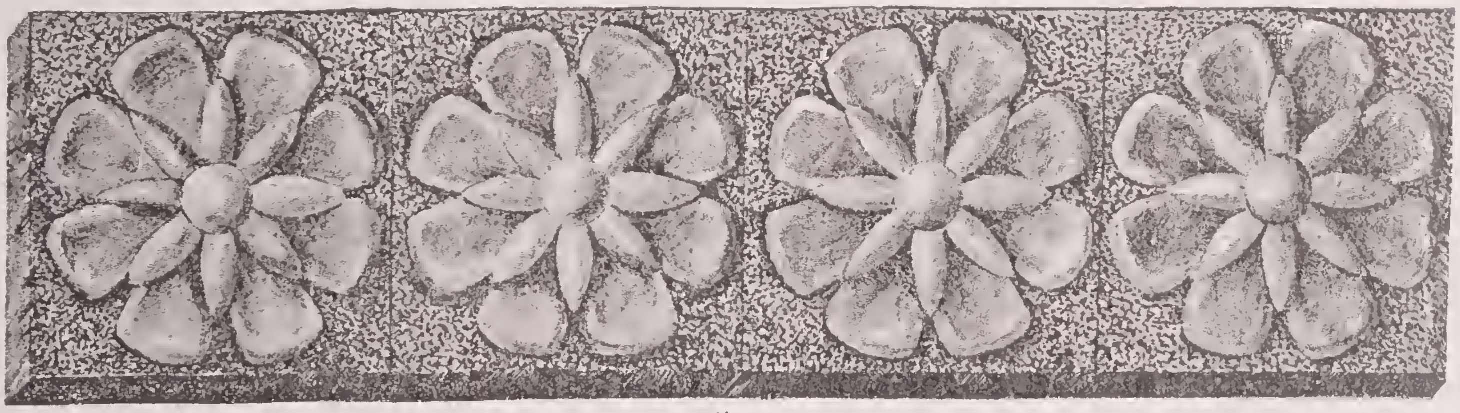


Fig. 37

turning the tile. In other words, the hands must learn dexterity by doing things that are not easy when first attempted.

When sufficient practice has been had in making tiles embellished with these suggested forms and others similar in character, it is a good plan to undertake the making of several borders, or friezes, on which a conventional design may be repeated several times.

Fig. 38

Figure 37 shows a border consisting of a series of single rosettes. Figure 38 introduces the fleur-de-lis. In making these borders, the work should not be crowded. Make a piece not less than six by

eighteen, or eight by twenty-four inches. This would divide into three squares. The repetition of the design will test in a very high degree the modeler's skill in accuracy and the sense of form.

In all these exercises, avoid making the tiles and borders too small. The educational benefit comes very slightly from delicate picking with the tool, but to a large degree from bold, rugged modeling with the hands or the forming of large designs with sweeping curves of the tool. It is not so easy, at first, to make large forms well as it is to make smaller ones, but greater manual dexterity comes from accurate bold movements than from restrained ones.

## NATURAL FORMS—ADVANCED WORK

The beginner's work was done on natural forms—the egg, the apple, the dog, etc.—all of which were, of course, modeled but roughly. It is not to be expected that either drawing or modeling will be other than crude in the first stages of the work. The development of skill in making the geometric and conventional forms, and successful practice with the fruit and vegetable models, will gradually lead up to advanced work in natural forms. They may unhesitatingly be given preference over any other class of models for the serious work of more or less skilful modelers.

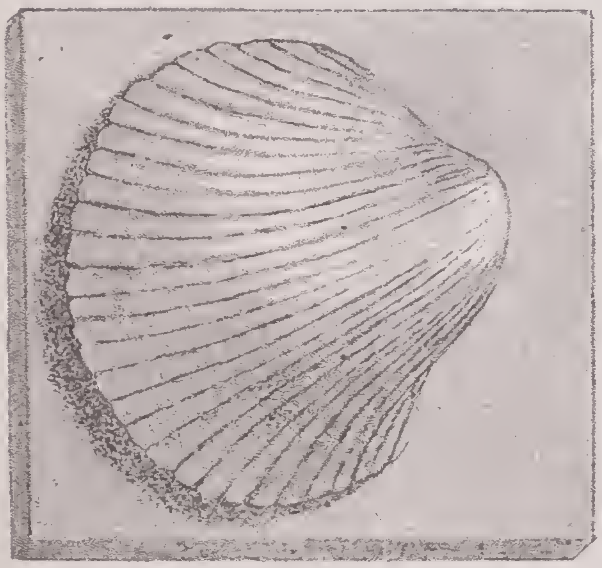


Fig. 39

A shell is an excellent model. Its delicate fluting, whorls, spirals or scallops, its charm of form and color and the mystery that attaches to it as the deserted home of a once living thing that dwelt in the green, silent depths of ocean, make it at once a beautiful model and the teller of a story. A wooden cylinder tells us no story, nor is it beautiful.


Fig. 39a

Flowers usually present more or less difficulty in modeling, owing to their delicacy of form.

The animal forms prove to be the most satisfactory of all. The pupil takes great interest in reproducing them accurately in clay and, if the purpose of making clay-modeling and nature study interdependent is adhered to, there is always something new to be learned concerning the subject in hand.

For models, it is possible to obtain fish, preserved and mounted on wooden panels, stuffed birds, butterflies, etc. The Barye casts of ani-

mals are the best models to be had of the quadrupeds, but the animals of the household or the farm, which are near at hand, should also be made to « pose.» They will not remain in one position for long at a time, but if the modeler has patience, and will persevere, the clay can be shaped into a suitable likeness of the living animal.

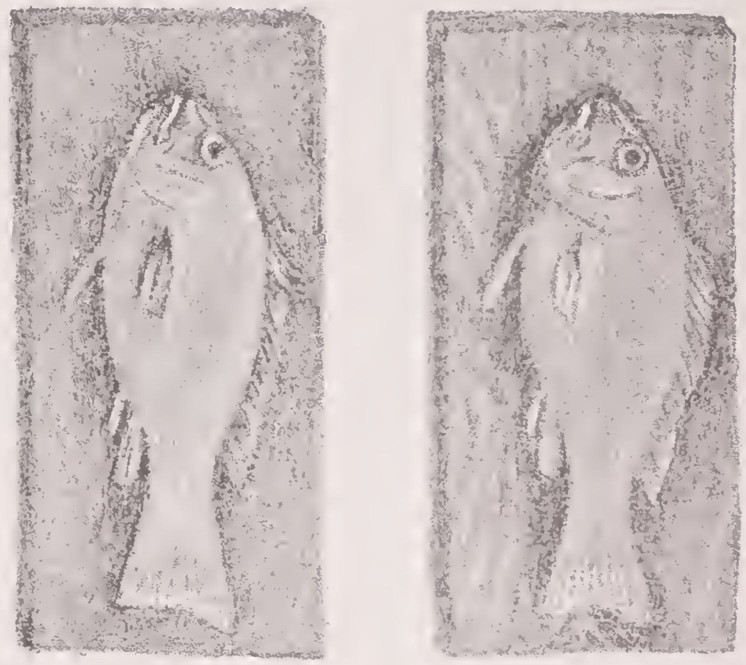


Fig. 40

These animal forms may be modeled in relief on panels, as in the case of the tiles already described, and also modeled in the round, with a substantial base to serve as a support. In modeling in the round, it is a good plan to begin with an animal's head — the one of which you can obtain the best model. For a complete animal form, the base or pedestal on which the animal is to rest is first made and then a mass of clay larger than the body of the proposed animal figure is held in place by a second mass of clay used as a support from beneath. The form is given rough shape and left until the second day, when it will be found to have dried and shrunk somewhat. In another day it will be quite hard. Clay can now be added to this substantial core and the actual modeling of the form may begin.

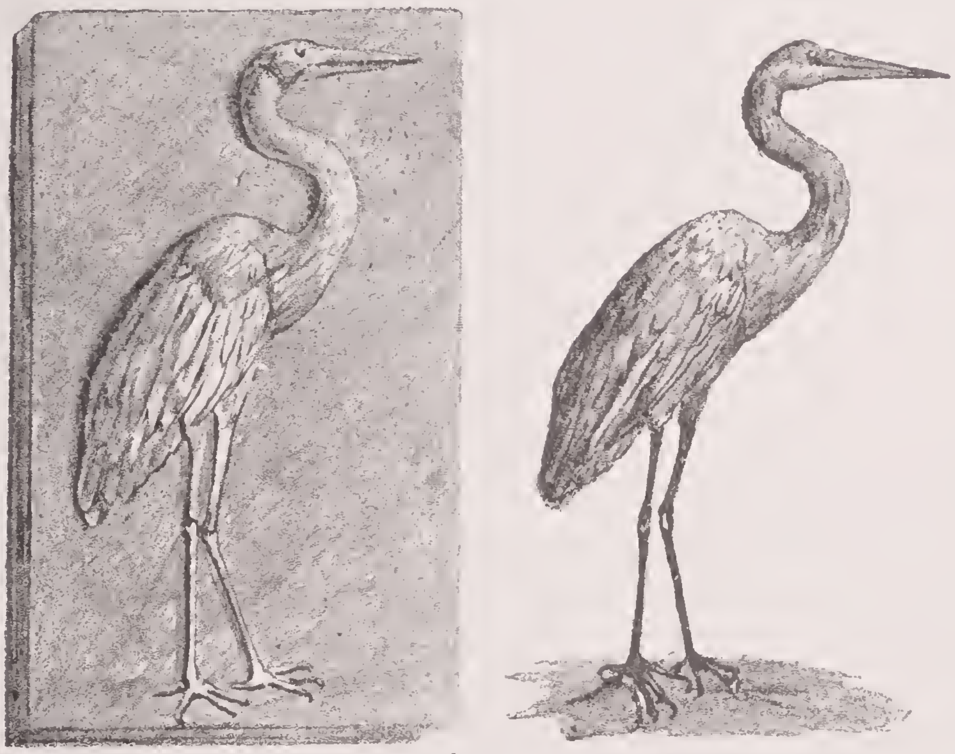


Fig. 41

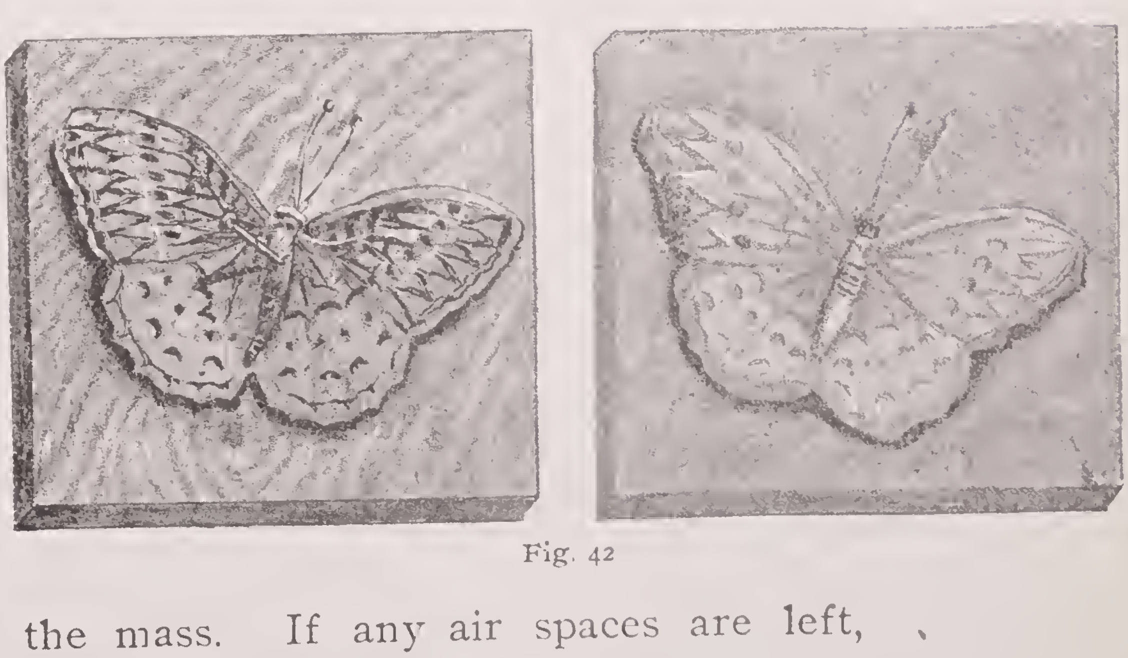


Fig. 42

The shape should first be blocked out roughly, without attempting to indicate features. As piece after piece is added, to build up the block, take care that each is thoroughly incorporated with the mass. If any air spaces are left, the clay may crack or drop apart after it dries, or when it is fired.

The tool may be used to reduce the block to a semblance of the model, but the hands should be used as much as possible. Sculptors often model the most delicate features of their work with the thumbs and fingers alone. Their sense of form enables them to produce perfect likenesses of individual human faces in this way; and it is obvious that similar practice is excellent for young modelers in cultivating the sense of form.

Fig. 43

While this work is in progress, care must be taken to keep the clay of the right consistency. The core must not be too dry, or the added clay will shrink the more of the two, and there will be serious cracks. When the modeling has been completed and the clay has shrunken so that it is comparatively hard, the support may be cut away, leaving the weight of the body to rest on the legs. Pieces of wood, pipe, or wire are sometimes used as supports, inside the animal's legs, but it is much better to make the form wholly of clay. When a good one is made, it can be fired and will then be permanent. If a plaster cast is to be made and the modeled form thrown away, the wood or metal supports may be used, but the modeler will derive the greater satisfaction from having his original work in permanent form.

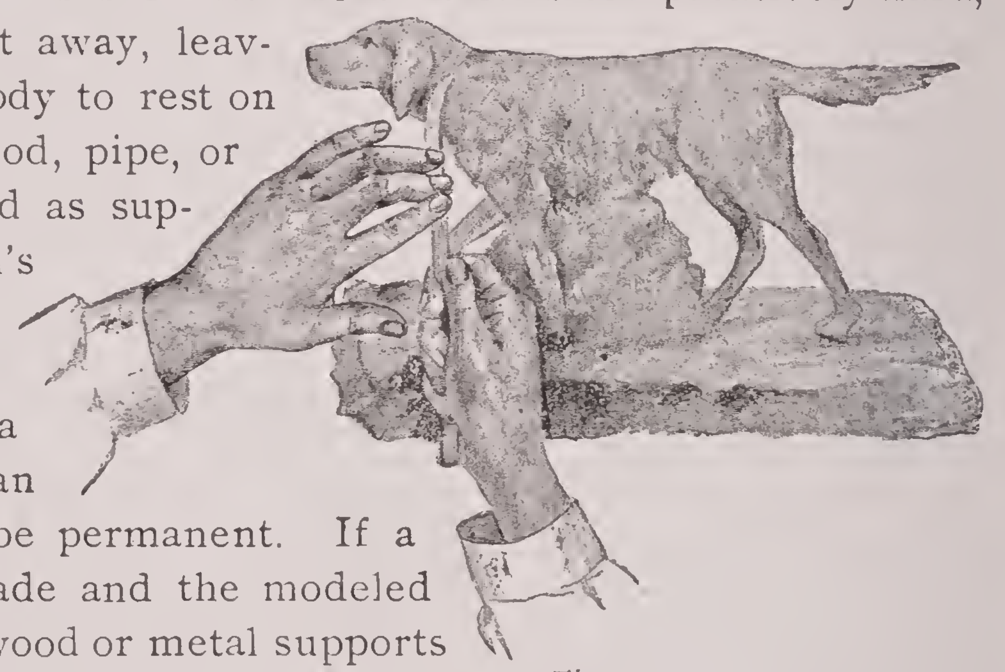


Fig. 44

In all clay-modeling, an effort should be made to become expert in representing texture. The skin of a potato is quite different from that of an apple; a lion's mane should not look like the feathers of a bird. In general, learn to measure with the eye. The dividers and the rule should be used only for comparing measurements or for laying out work that it is desired to enlarge on an exact scale.

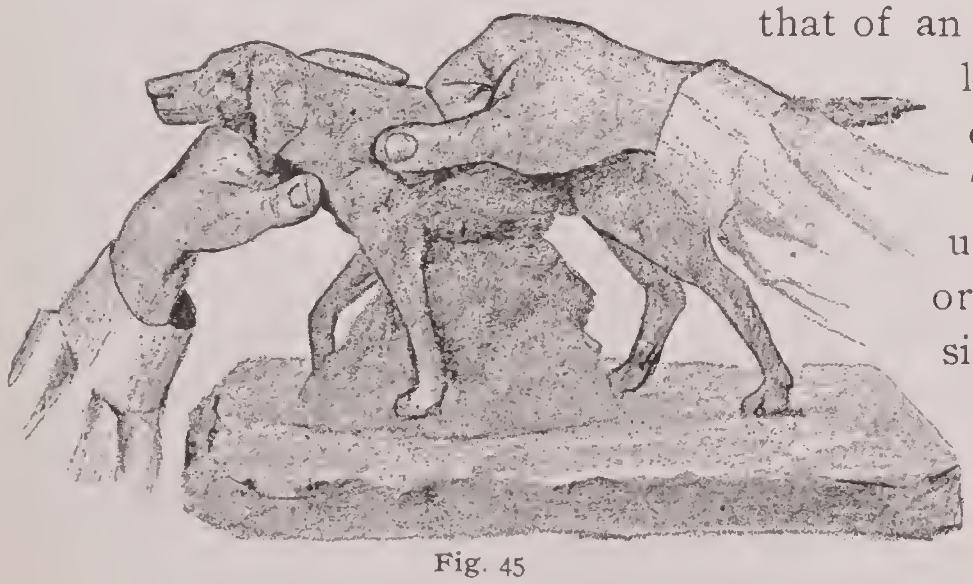


Fig. 45

It is almost out of the question to lay down a printed set of rules for the guidance of modelers. This chapter is intended only to make pertinent suggestions as to following an orderly course of study, with some hints as to the character and manipulation of clay to enable

the beginner to enter upon the work with confidence. The real secrets of the art he must learn by actual experiment. That is, indeed, the actuating principle of Manual Training — "to learn by doing."

It is especially desired to call to the attention of parents and guardians the advantages of clay-modeling as a help in educating children not so fortunate as the average, in that they are "backward," feeble-minded, or of such frail constitution that wearisome book-tasks must not be set them. These unhappy little people especially need such employment as clay-modeling affords. They may not be able to do serious work, but the advantage to them, mentally and physically, of some such healthful and diverting occupation, has already been exemplified in many cases.

Clay-modeling suggests a higher step in Manual Training. However beautiful the forms made in clay may be, they are fragile. The desire to produce similar beautiful forms in a more enduring substance leads the successful clay-modeler to look forward to wood-carving.

# SLOYD

MANUAL Training, as a system, is not new. It dates back to ancient Greece and Rome. Greece imparted to her youth physical as well as moral and mental training. In Rome the physical at one time predominated over the mental. With the revival of learning, due to the advent of the printing-press in the fifteenth century, an extensive knowledge of classical writings was demanded of scholars and the training of the physical man in harmony with his mental development was slighted until it came to be wholly disregarded. This gave rise to a system of education which was dominant for four centuries, and it still exists in those of our schools which are schools of learning, not of training.

Locke, in the seventeenth century, advocated Manual Training, as did Jean Jacques Rousseau, in the eighteenth. "If, instead of chaining a child to his books," he said, "I occupy him in a workshop, his hands labor to the profit of his spirit, he becomes a philosopher, though he thinks he is a workman. Now, of all occupations which serve to furnish subsistence to man, that which brings him back to nature again most closely is the work of the hands. 'A trade for my son! my son an artisan! Monsieur, what are you thinking of?' 'Madam, I think better of him than do you, who would render him incapable of ever being anything but a mere lord, a marquis, a prince, and perhaps one day less than nothing. While I, for my part, wish to raise him to a rank which cannot be forfeited, a rank which makes him honorable for all time. I wish to raise him to the rank of manhood, and, say what you will, he will have fewer equals in that title than in those you will give him.' 'The letter killeth, the spirit giveth life.' It is not so much a question of teaching a trade for the sake of the knowledge of the trade, as of overcoming those prejudices which despise it. . . . I desire without reserve that Emile should learn a trade." . . .

"Everything taken into consideration, the trade which I should above all wish to be chosen by any pupil is that of the carpenter. It is neat, it is useful, it can be followed at home; it provides abundant exercise to the body; it demands in the worker some skill and industry; and though the form of the work is determined by its utility, yet elegance and taste are not lost sight of. . . . We are not apprentices to a trade — we are apprentices to *manhood:* and this

latter apprenticeship is more troublesome and longer than the former. . . . »

« He must work like a peasant and think like a philosopher, unless he is to be worthless as a savage. The great secret of education is to make the exercises of the body and of the spirit serve each to relieve the other.»

Froebel gave the first strong impetus to the demand for Manual Training, in our own time, through his kindergarten system.

In far-off Finland, however, definite Manual Training was first made a part of the national system of education, through the advocacy of a native clergyman named Uno Cygnæus. Its teaching was begun in 1866. The movement spread to Sweden and Norway, where it developed rapidly, and later to France, Germany, and Great Britain. In these countries Manual Training is generally considered under the term Sloyd. Sloyd is the English equivalent of the Swedish « Slöjd,» which means skill, or dexterity, especially mechanical skill; and « Sloyd-work» means, definitely, work which employs mechanical training as a part of general education and not as preparation for a trade. It is « educational handwork.»

In the beginning, however, Sloyd was based on an economic, rather than an educational, purpose. It was intended to preserve and advance home industries, by producing skilled workmen at an earlier age and in greater numbers than had previously been the rule; and basket-making, saddlery, turning, and other woodwork were taught to boys, while weaving, knitting, sewing, spinning, and cookery were taught to girls. The purpose was utilitarian, not educational.

All this was changed by Otto Salomon, whose name has come to stand for the genius of Sloyd. Otto Salomon was born of Jewish parents at Gothenburg, in 1849. He was trained in preparatory schools and the gymnasium, and entered the academy for the training of engineers. He left to assist his uncle in the management of the latter's large estate, and to qualify himself for his duties, attended an agricultural institute, in 1870. At the same time he assisted the parish schoolmaster and started an evening school for farm servants. About this time Sloyd schools were opened in the neighborhood and both Salomon and his uncle became intensely interested in the work. They opened Sloyd schools and later a training department for teachers. Since that time Salomon has devoted himself heart and soul to the advancement of Sloyd.

He soon saw that the economic purpose of the Sloyd schools was bad for schools and pupils, and with great energy he set himself to the work of recasting them on educational lines. This he successfully accomplished.

The first Sloyd teachers were artisans who knew nothing of teaching as a science; and Salomon saw that to get educational advantages from Sloyd he must have ordinary teachers trained in Sloyd-work. The artisans were displaced and such teachers took up the work. Simultaneously, the utilitarian purpose of the schools was destroyed and in its place was developed the splendid educational force of Sloyd. This experience has been repeated in this country, where Manual Training schools have found it profitable to dispense with the artisan and employ regular teachers. As a rule, the artisan has enjoyed few educational advantages; he has learned carpentry as students learn Latin, by rote; and in any event the finer sympathetic and esthetic side of teaching is a sealed book to him. Regularly-trained teachers, who have passed from the theoretical schools into schools of Manual Training, have reached the highest degree of success in this work.

The unthinking mind will be likely to decide offhand that a carpenter can teach woodwork better than a teacher who never was a carpenter. But it is educational woodwork that Manual Training contemplates, and experience proves the wisdom of employing the generally-trained teachers. In one of the large cities, the teaching of music in the public schools is intrusted to a young woman who, for ten years, had taught the ordinary branches in the graded schools. She is not a musician, can sing or play but indifferently, yet her music classes make wonderful progress, and she has attained a proficiency in her work that has amazed the school authorities, who at first regarded her appointment as a doubtful experiment.

One of the first principles of Sloyd is that children shall be taught as individuals and not as a class. In class teaching, the teacher is likely to regard the class as a unit and to proceed upon the same plan for all; indeed, it is difficult with a large class to adopt any other method. But this does not produce individual development, and the normal development of one child, as a rule, calls for methods of treatment which are not suited to another. All children cannot keep the same pace in learning; some are slow and others swift, yet in accord with the capacity of the brightest pupils, not the dullest, who most need to be developed, the work of the class as a whole proceeds inexorably.

The promoters of Sloyd recognized the defect in class teaching as a means to education, and undertook to educate the individual. There is a difference between instruction and education. Instruction in manual work, which is designed to implant knowledge, may be given in class; but education, which seeks to develop the faculties, must necessarily be individual. Sloyd-work gives this individual training from which comes education. As the work of the class-room often fails

because the pupils cannot keep the same pace, so Sloyd-work might fail if the attempt were made to teach it in class,— that is, to give out a set of models and expect all the pupils to attain the same degree of excellence in the same time. The theory of class-teaching has been that the dull pupil learns from the bright one, and that the desire to maintain a creditable standing induces ambition in the dull pupil. The fact is, however, that the dull pupil leans upon the brighter one, and so makes less progress than he would by himself.

Sloyd teachers are required to address only one pupil at a time, instead of stopping the work of the entire class, so that the latter may listen to what is said. To interrupt the work of all in order to state something required for the instruction of an individual, and which may not be required by all, takes the minds of pupils from their work, involves moments of idleness, and prevents progress.

Considerations of economy affect all general educational systems. Appropriations from the public funds for the maintenance of schools are seldom based on accomplishing the greatest possible amount of good, but on providing the least number of educational facilities that will be tolerated by the public. Class-teaching is made necessary by the fact that funds are not available for the employment of a sufficient number of teachers to do individual work. This form of economy suits the childless taxpayer for the time being, but it dwarfs education and denies to the ripening years of youth the preparation for after life that should be afforded. Recognizing this fact, the Sloyd schools of Sweden employ at least one teacher for every twenty pupils, and experience has shown that better results are attained where the number of pupils under a single teacher's supervision does not exceed twelve or sixteen. In Sloyd-work there are so many tools and manipulations that the individual pupil needs frequent attention, and when as many as forty pupils are placed under a single teacher, it is found that the objects produced are wholly useless, and the work is a failure, because sufficient instruction had not been imparted to make effective education possible.

Under the class system, the directors of Sloyd found the same difficulty in keeping their classes together, that is, the pupils equally advanced, that troubles all teachers. Some Sloyd pupils finished their work more quickly than others. Such pupils, in some cases, were told to repeat the same work, in order that the remainder of the class might catch up, but this was found injurious, for the pupil, having done one thing well, naturally desired to take up more advanced work; and his need of repeating the work already done, as a matter of increasing his skill in certain manipulations, was far less than that of the tardier workers. To provide no work for those who have finished

would be equally bad, or even worse, as it would promote idleness, and the spectacle of one pupil idling after having quickly completed his work, would have a depressing effect on the pupils still striving to reach the goal. Therefore, they have abandoned the class system in favor of individual instruction,— that is, a class may be at work at the same time, but upon different objects.

In Sweden, where Sloyd has reached a high stage of development, the term embraces not merely such woodwork as carpentry, carving, fretwork, and turning, but also work in brass, iron, wire, leather, and cardboard; besides brush-making, basket-making, bookbinding, straw-plaiting, and coarse painting. In England, the term Sloyd is generally applied only to woodwork. In America, the term Manual Training is employed almost exclusively to designate the same system.

Education is generally considered from one of three points of view, first, the utilitarian, second, the disciplinarian, and third, a compromise between the two. The utilitarian method looks to making the knowledge acquired of practical use. The disciplinarian methods regards education as, properly, formative, and seeks to develop the powers and faculties of the child not for special, but for general application.

The promoters of Sloyd consider it as purely formative education. It is not regarded in any sense as a part of technical education, and is intended to be a part of the general education in elementary schools. For those who wish to learn a trade, there must be a subsequent course in a technical school. The formative aims of Sloyd are set forth in the following order by its advocates: —

1. To instil a taste for, and a love of, labor in general.
2. To inspire respect for rough, honest, bodily labor.
3. To develop independence and self-reliance.
4. To train in habits of order, exactness, cleanliness, and neatness.
5. To train the eye and sense of form. To give a general dexterity of hand, and to develop touch.
6. To accustom to attention, industry, perseverance, and patience.
7. To promote the development of the physical powers.

It has also the utilitarian aims: —

1. To give dexterity in the use of tools.
2. To execute exact work.

It will be seen that these aims are in general the same as those previously outlined in this volume as the essential purposes of Manual Training for American pupils.

Mr. Salomon, speaking of the various materials which may be used in educational Sloyd, such as wax, clay, pasteboard, paper, metal,

and wood, recommends wood as the most suitable. Sloyd carpentry, he says, is adapted to the mental and physical powers of children, and awakens and sustains genuine interest by enabling them to make useful articles. It admits of cleanliness and tidiness in the work and, he adds, it cultivates the sense of form more completely than instruction in drawing does. It also promotes physical development. The exercises are easily adapted for methodical arrangement, and may comprise those of varying degrees of difficulty, for the theory of instruction in Sloyd is that it shall proceed from the easy to the difficult, from the simple to the complex, from the known to the unknown. It is essentially constructive, and not analytical.

The carpentry of Sloyd differs from the carpentry of the artisan in all save the material used. The articles made in Sloyd carpentry are smaller than those made in workshops; they introduce curved outlines, while the artisan's work is usually on rectangular or cylindrical lines; and a difference exists in the use of tools. In Sloyd, the knife is considered to be the most characteristic tool, while the carpenter rejects the knife in favor of the chisel. Moreover, in practical carpentry there is a division of labor which is antagonistic to the principles of Sloyd.

Turning and wood carving were formerly largely employed in Sloyd-work, but Mr. Salomon looks upon them with disfavor, and his views have been so far accepted that in Sweden, at least, these branches of woodwork are now oftener absent than present in Sloyd schools. Turning involves preliminary exercises not on the objects to be made, which is contrary to the practice of Sloyd; and the difficulty of procuring suitable turning-lathes has been another obstacle. Wood carving is objected to as too « fine » a class of work, which does not call for sufficient bodily exertion and is pronouncedly ornamental, so that it does not produce that respect for rough bodily labor that Sloyd carpentry aims to inculcate. Wood carving, applied to articles on which the rough work has previously been done by the pupil, is regarded as sometimes desirable, but applied to objects made by others is considered undesirable.

In the Manual Training schools of the United States, wood carving has been made a prominent factor of educational work, and the advantages derived from it are regarded as infinitely superior to the objections of the original promoters of Sloyd. It inspires a love for the beautiful, for one thing, and develops accuracy and a feeling for form; and in subsequent sections of this volume its utility will be made apparent.

The method of Sloyd includes the arrangement of a series of exercises and a series of models in such a way that the knowledge gained in the preliminary exercises may be applied upon the models

without delay, the work thus going forward systematically and retaining the interest of the pupil by enabling him to produce completed articles. A provisional list of exercises prepared by Mr. Salomon numbers eighty-eight. The first four of the exercises deal with simple knife-cuts; they then proceed with sawing, planing, squaring, gauging, boring, filing, beveling, scraping, chiseling, chopping, pegging, nailing, dovetailing, panel-grooving, mitering, lock-fitting, hinge-sinking, staving, hooping, etc. A list of fifty models, also prepared by Mr. Salomon, begins with a small pointer, flower-stick, pencil-holder, etc., and goes forward to bowl, scoop, clothes-rack, foot-stool, box, ax-handle, bracket, picture frame, bookshelves, hooped bucket, cabinet, small table, etc. In producing work, he says, the question should be not how much or how many objects can be made, but how well the work may be performed.

Sloyd seeks to give an intelligent knowledge of the material used, as well as the tools, and as wood is chiefly employed, its structure and composition, the changes it undergoes, and a comparison of the qualities of different kinds of wood, enter into the instructions given. This imparts accurate information as to why woods shrink and crack, and suggests the means of preventing warping and cracking, where a large plane surface is desired, by seasoning the wood, before use, and in use, by jointing.

A comparison of the qualities of different woods is valuable The chief qualities of wood are its strength, the ease or difficulty with which it may be split, hardness, toughness, elasticity, texture, color, smell, weight, durability, and its capacity for shrinking or swelling.

The directors of Sloyd-work lay great stress upon a proper choice of tools. The tools must be adapted to the capacity of the pupil, neither too large nor too heavy. The use of miniature tools, that is, sizes such as are usually made for children's tool-boxes, is condemned, partly because such tools are usually of very inferior quality, and again because it is found that greater skill and dexterity come from the manipulation of tools which in size and weight have been found, from long experience best adapted to their several uses. There is another consideration, and that is the preference of the pupil for standard tools — he does not want «boys' sizes» when he is trying to do the same work that men could do, and takes greater pride in his work if his tools are such as would be used by men. At the same time, it is necessary to bear in mind that the child's hands are not so large and powerful as a man's and the handles of tools, such as the knife and the chisel, should be of a size that enables him to grasp them easily and wield them efficiently without undue strain, which will produce unnecessary muscular fatigue.

Tools of good quality are considered indispensable, and, once procured, they must be kept in good order. Motives of economy might suggest that children should not be allowed to undertake the sharpening of expensive tools, but in Sloyd the method followed is to teach pupils to sharpen their tools, and to require them to keep them in good order. Poor work almost always results from the use of tools in bad condition. The teacher must thoroughly understand how to sharpen tools, including the use of the grindstone, the oilstone, the saw-set, and the file, and by easy stages to impart this knowledge to the pupil. The child may spoil a tool, now and then, but if properly directed, this will be a rare occurrence, and the educational value derived from learning to care for his tools will more than compensate for the financial loss.

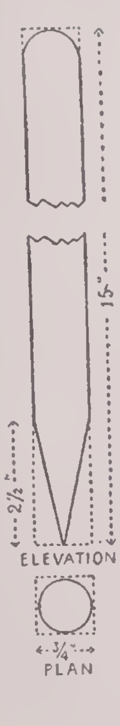
# ARTICLES FOR YOUNGER CHILDREN TO MAKE

Young children may derive great benefit from simple work in wood. They should not be allowed to use chisels, drawknives, and hatchets, until they have established a reputation for carefulness, but the knife, the saw, the plane, the file, and the gauge may be intrusted, without misgivings, to children ten or eleven years old. It is expected, of course, that in the use of these tools they will have the direction of a parent or guardian, who will give them some instruction and teach them at least to handle the tools without danger to themselves.

The work attempted by young children should be simple and of a character to appeal to their love of useful things. Much can be done with the knife alone, and the first exercise should employ that tool only. Work of this kind will not miss its object if the child learns to appreciate accuracy and is stimulated with a desire to "do" greater things.

## No. 1. A FLOWER-STICK

Making a flower-stick is a good exercise to start with. This is not merely an ornamental, but, more strictly, a useful, object, and may be handed to the gardener, when completed, for use among his plants. If the child sees his own handiwork thus made serviceable, he will be pleased with the sense of accomplishment that comes to him.



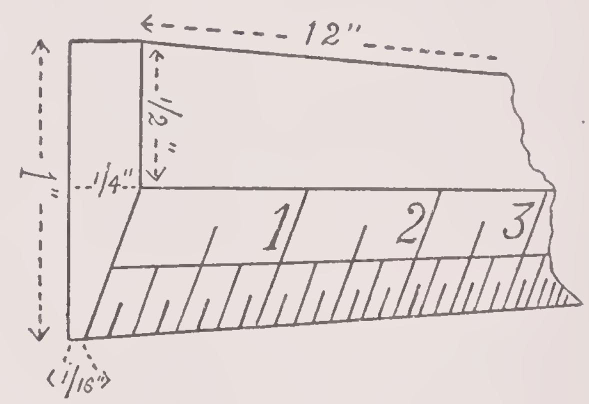

Take a piece of pine, $\frac{3}{4}$ inch square and 15 inches long. With the knife cut four new faces on the stick, making eight in all, so that it will be octagonal. Then make the stick as nearly round as you can, taking off very thin shavings in succession and drawing the knife the whole length of the stick at each stroke. When you have made the stick round, set off a point $2\frac{1}{2}$ inches from one end. From this mark, taper the stick to the near end, so as to form a point which may easily be pressed into the ground. Now carefully cut away the sharp edge at the other end and round it as neatly as you can. Do all this work with the knife and see how smooth a surface you can make.

You can make another flower-stick, but instead of rounding it with the knife, put it on the bench and with the plane reduce it to six sides, instead of four. Then make a point $\frac{1}{2}$ inch from one end and draw a line around the stick at this point. This line will be the base

from which you can taper the sides of the stick to a sharp point. Finish the end of the stick that is to enter the ground, as you did the stick just made. With the knife, cut two very shallow notches around the stick, one $2\frac{1}{2}$ inches from the top, the other 6 inches below the first. These will serve to catch the strings and hold them in place, when the plant is tied to the stick.

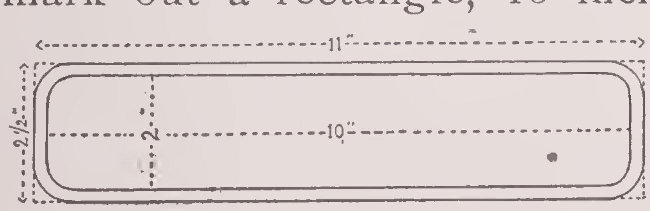
## No. 2. A BEVELED RULER

From a piece of birch wood, saw a stick 12 inches long and 1 inch wide. Reduce it with the plane to a thickness of $\frac{1}{4}$ inch. On one face, lay off with the gauge $\frac{1}{2}$ inch and draw a line parallel to the edge of the stick. With the gauge mark a line $\frac{3}{16}$ inch from the face, on the edge. Now chamfer the corner between these two lines, with the plane. Finish all surfaces of the stick with the smoothing-plane. With the dividers lay off spaces on the beveled edge, and with the point of the knife draw lines through these points, extending across the chamfer. These lines may be blackened with a needle heated red-hot in a gas-flame or in the coals. The slight cut made by the knife will guide the point of the needle. Take care not to make the lines too broad. Make clear numbers, 1, 2, 3, etc., against the inch lines. This makes a neat and serviceable ruler. You can make it still more useful as a measure by marking off half-inch, quarter-inch, and eighth-inch spaces and blackening the lines.




## No. 3. PEN TRAY

Cut a piece of birch 11 inches long and $2\frac{1}{2}$ inches wide. Plane it smooth and reduce it to a thickness of $\frac{3}{4}$ inch. On the working face, mark out a rectangle, 10 inches long and 2 inches wide. With the compasses, round the corners of the rectangle to quarters of a circle. Use the gouge to cut out the wood within the marks, but be careful not to go more than $\frac{1}{2}$ inch deep. When you have removed the greater part of the wood with the gouge, use the scraper to produce a smoother surface, and then finish carefully with fine sandpaper. The ends and sides should slope to




PLAN

SECTION

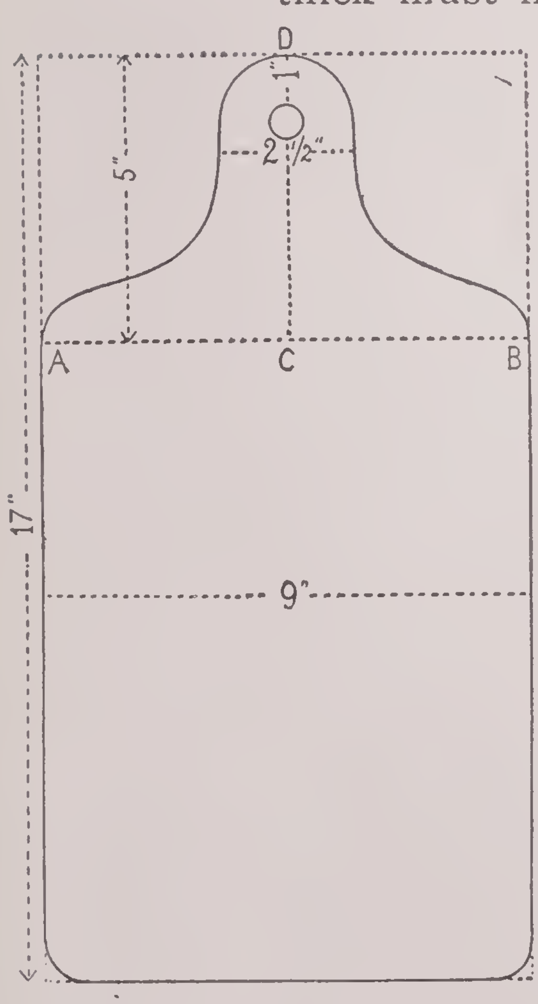

ELEVATION

the bottom of the tray in a long curve, and not at an abrupt angle. The outside of the tray is now to be finished. Round the corners with the compasses, and with the chisel pare them to the curved line. First with the plane and then with the knife, reduce the sharp corners of the underside to a curved surface and curve the upper edge in the same way. A smooth finish is obtained by using first the scraper and then the sandpaper. It will take some time to complete the pen tray if you do the work well, so do not hurry it but divide the work into two or three periods. This tray may be kept on the desk to receive penholders, pencils, etc.

## No. 4. BREADBOARD

Here is an opportunity to make something that will be useful to mother, in the kitchen — a clean, nicely-finished breadboard.

A piece of white wood 17 inches long, 9 inches wide, and 1 inch thick must first be gotten out. Plane one face and one edge smooth.

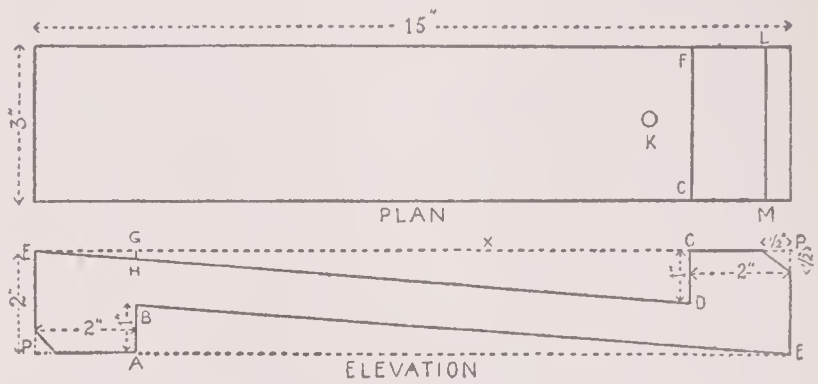



With the gauge, lay off 5 inches from one end of the board and, with the beam of the square pressed against the working edge, draw a line AB. Find C, the center of AB and draw CD. Draw the round end at D with the compasses and then draw the curves of the handle, making them graceful and flowing. Let the handle be $2\frac{1}{2}$ inches wide at the point where it will be grasped. Now, with the compass-saw, cut along the curves of the handle and pare the edge with the chisel. Go over both faces, the wide ends and the parallel edges, with the smoothing-plane and, if necessary, use the scraper to produce a very smooth surface. With the smoothing-plane take off a hair-like shaving from the corners, around both faces of the board. With the center-bit bore a hole, $\frac{1}{2}$ inch in diameter, one inch from D. By means of the hole, the board may be hung on a nail in the pantry. The board may be used as a chopping-board, as well as to cut bread upon. After a time, if it becomes badly hacked, you can dress it with the smoothing-plane and give it a clean, fresh surface.

## No. 5. BENCH-HOOK

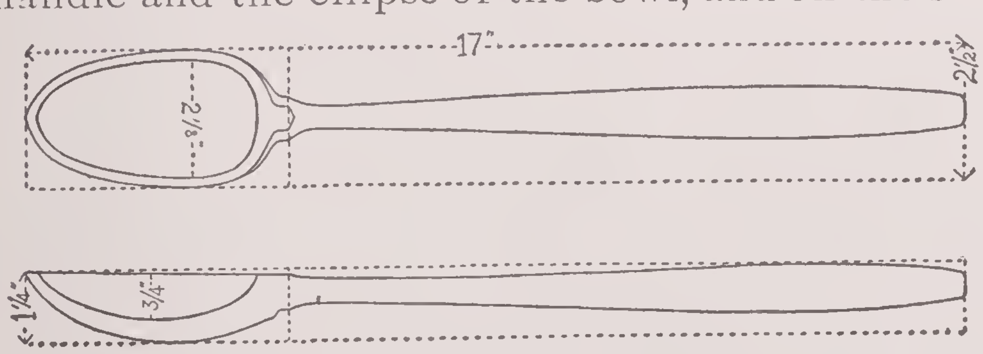
Making a bench-hook affords good practice in the use of tools, and the article itself is very useful on the bench. Saw out a piece 15

inches long, 3 inches wide, and 2 inches thick. Plane one face and one edge and mark each with an « X.» On the working edge, X, lay off 2 inches from each end, and draw AB, CD, each 1 inch long, with the square, perpendicular to the face. Connect the points B and D with the corners, E. Draw CF across the face, parallel to and 1 inch from the end, and repeat the first markings on the opposite elevation; then from A draw a line across the lower face parallel to the end and 1 inch from it. Saw out the triangular pieces, ABE, CDE. You may find it hard to start the saw at the proper angle at E. A remedy for this is had by fastening the stick in the vise against another block of wood. This has the effect of extending the face beyond E and the saw will take the line easily. Or you may make a saw-kerf, like GH, near the end, and cut out the small triangular bit of wood, EGH, with the chisel. The saw will then start easily at H. When you have sawed the oblique lines ED, EB, with the rip-saw, saw AB, CD, with the back-saw. The hook may now be finished with the smoothing-plane, and the corners, P, chamfered and rounded with the chisel from LM outward. With the bit, bore a hole ½ inch in diameter at K, so that the bench-hook may be hung on a peg. You will find the hook very useful when you have occasion to saw through pieces of wood and wish to avoid cutting the bench.




## No. 6. SPOON

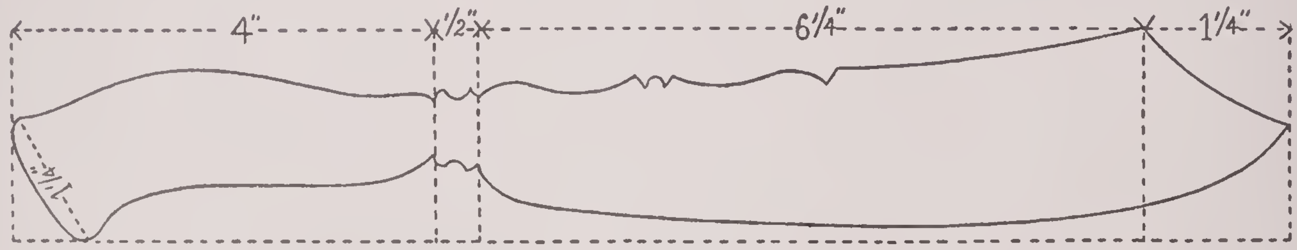
A good exercise is to make a spoon, which will be found very useful in the kitchen. Select a piece of birch, 17 inches long, $2\frac{1}{2}$ inches wide, and $1\frac{1}{4}$ inches thick. On the face of the wood, draw the plan of the handle and the ellipse of the bowl, and on the side mark out the elevation. At the shoulders formed by the junction of the handle with the bowl, cut holes with the center-bit. With the saw cut nearly to the lines of the handle and the shoulders of the bowl. The bowl must now be hollowed out with the gouge and made smooth with sandpaper. Now saw the under curve of the bowl with the saw, and also saw the lower line of the handle. The greater part of the superfluous wood has now been removed. The remainder of the work consists in modeling the



bowl and handle. In this work, the knife should be the tool chiefly used. It may also be necessary to use the file and spokeshave, and the finishing may be done with sandpaper. In modeling the convex surface of the bowl, be careful not to cut too deep and so make the bowl of the spoon too thin. Try to have the bowl symmetrical, so that the rim will be a perfect ellipse, and let the convex side present a graceful curve. The bowl should be thicker at the bottom than at the ends and at the rim.

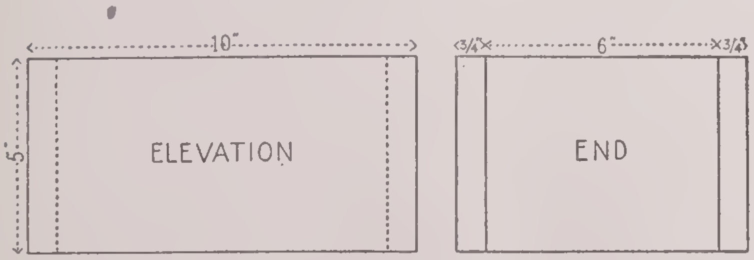
## No. 7. PAPER-KNIFE

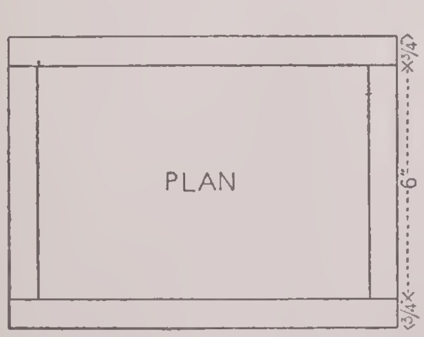
A PIECE of birch or cherry can be made into a pretty paper-knife. Take a piece 12 inches long and 2 inches wide, and with a plane reduce it to a thickness of $\frac{3}{16}$ inch. Draw the outline of the knife, and with the saw, cut as near to the outline as you can. Model the handle

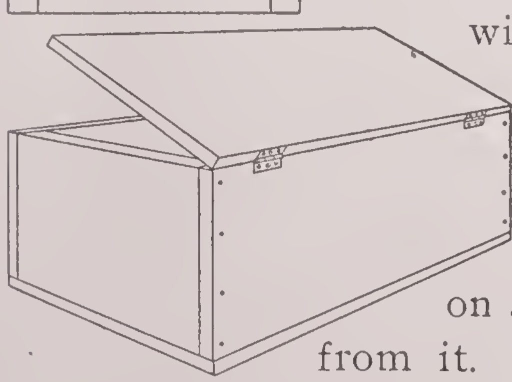



and the blade with the knife. To reduce the blade to a thin edge, on one side, mark the center of the edge with the marking gauge and cut to this line on both sides of the blade, with the knife. Use the knife to model the notch between the blade and the handle, and to round the handle. The work may be finished with the scraper and sandpaper.

## No. 8. BOX



To MAKE a small box, get out four pieces from a board $\frac{3}{4}$ inch thick. Two pieces must be 10 inches long, for the sides, and two 6 inches long, for the ends. All will be 5 inches wide. Dress the boards with the jack-plane and finish with the smoothing-plane. Fix one of the end-pieces in the vise, side edge upward. Start three nails in one of the side-pieces, on a line parallel to the end and $\frac{3}{8}$ inch from it. Hold the side-piece flush with the end in the vise, and drive the nails home. Use a brad-awl to make holes in which to start the nails, so that you will not split the wood.

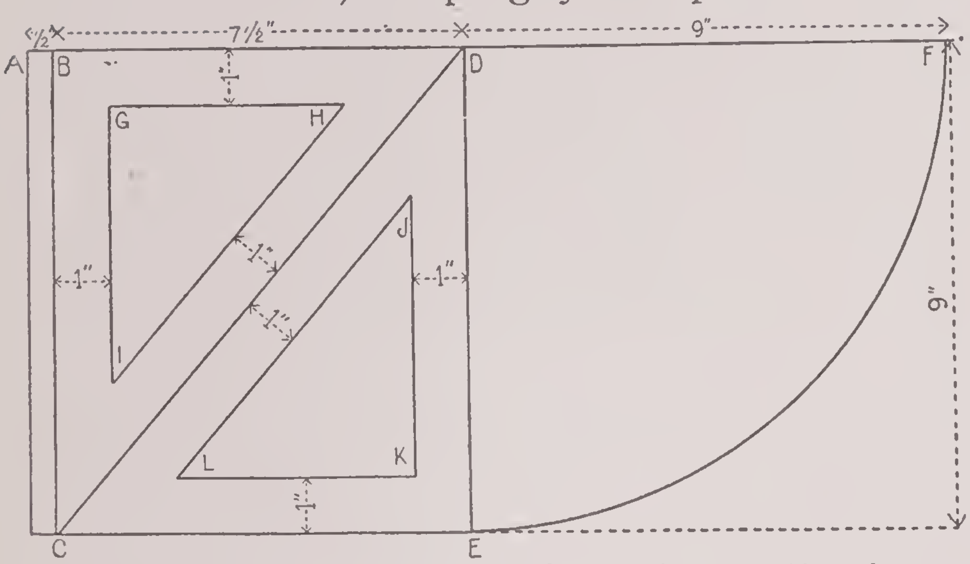
Use five-penny or six-penny nails and drive them carefully, so that they will not bend. Now fix the other end-piece in the vise and nail the same side to it in the same way. Start nails at the ends of the other side-piece and then place it flush with the end-pieces, the whole resting on the bench. Nail the side to the ends. This gives you the skeleton of a box. You will now need to get out a piece for the bottom. Measure the length and width of the skeleton and saw a board a little larger than these dimensions. Reduce it to a thickness of $\frac{3}{4}$ inch and smooth it with the smoothing-plane. Place it on the skeleton and with the brad-awl make holes around the four sides. Be careful not to locate any nails so near the corners that they will encounter the nails which have already been driven into the end-pieces through the sides. Nail the bottom along one side, first, and then with the try-square test the skeleton to see if the corners meet at right angles. If they do not, press the skeleton into shape before nailing the bottom all the way around.

When all the nails have been driven, sink them with the nail-set, being careful that the latter does not slip and mar the wood. With the back-saw, trim the ends of the bottom piece close to the frame, and plane the long edges to make them flush with the side. Go over the outside with the smoothing-plane, and be careful not to split the ends when planing across the grain. Sandpaper the inside of the box, stretching the sandpaper over a block of wood while doing so. You can now make a lid for the box and supply it with hinges, like those shown in the illustration. They are fastened in place with screws. Select screws not more than $\frac{5}{8}$ inch in length, so that they will not pierce the side and lid of the box. Make holes for the screws with the brad-awl. Be sure that your hinges are not too near the center of the box, and are at equal distances from the ends.

## No. 9. CORNER BRACKET

There are many corners about the house where a corner bracket may be placed, and where it will serve very acceptably for holding a vase, a clock, or something that is purely ornamental. If well made, the bracket itself will be ornamental. From a piece of white-wood $\frac{1}{2}$ inch thick, cut a piece 17 inches long. Reduce the board to a width of 9 inches, with the plane. Make one end true and square. On the working edge, lay off $\frac{1}{2}$ inch, AB, and with the gauge set to that measure draw a line, BC, parallel to the end of the board. Lay off BD, and with the ruler draw DC. From C lay off E, $7\frac{1}{2}$ inches, and draw DE, at right angles to the edge of the board. Set

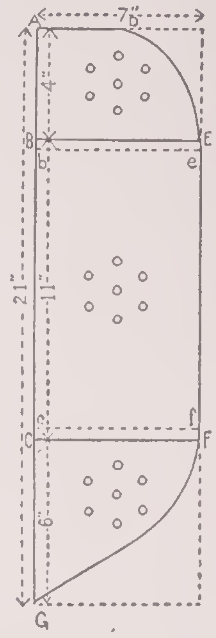
your dividers to a measure of 9 inches, and with the point on D, describe the arc FE. Now draw the inside triangles GHI, JKL, whose lines are one inch from the sides to which they are parallel, in each case. Hold your board on the bench-hook and with the back-saw, saw very carefully DC. Now saw DE. Bore holes with the bit at the corners of the inside triangles and with the compass-saw saw out the pieces GHI, JKL. With the knife, or with the chisel, make the angles clean and true. With the compass-saw cut to the arc FE, keeping just up to the line but never cutting it, and then with the knife make the arc a perfect quarter of a circle. True the edges of your triangles, so that they will be perpendicular to the face, in every case. Now place DCE in the vise with the edge DE upward, and against this edge place ABC, so that A will coincide with E. With the awl, bore through ABC into the edge DE, and then with long, slender wire nails fasten the two pieces together. Remove the work from the vise and see if the angle made by the junction of the two pieces is a right angle. Test the top with the beam of the square pressed against the face of the bracket, to see if the tops of the supports are in the same plane. Now fix one of the supports in the vise and lay the shelf in place. It will project one inch beyond the supports. With the brad-awl, make holes through the shelf into the supports and drive the nails. Countersink the nails with the nail-set and the bracket is finished. It may be held in place by means of screws, or supported on brass hooks, driven into the wall, which project beyond the edges GH, LK. The bracket will be more ornamental if stained with cherry or mahogany color.




## No. 10. BOOK-SHELVES

A neat book-shelf may be made without difficulty. From white-wood stock ¾ inch thick, get out two pieces, each 21 inches long and 7 inches wide. Saw and plane the ends square with the working edge. On the working edge lay off AB, 4 inches, and BC, 11 inches, and draw BE, CF at right angles across the board. Lay off AD, 3 inches, and draw the arc DE. Draw FG in the same way. With the compass-saw, cut out the corners DE, FG. In the center of each of the three spaces on the board, make a series of holes with the center-

bit. These break up the plainness of the board and give it a touch of ornament. Finish both boards in the same way. These are to be the sides of the book-shelf.




You now need two boards, $\frac{3}{4}$ inch thick, 7 inches wide, and 16 inches long, for shelves. Make these two boards perfectly square and smooth, taking pains to finish the ends neatly. On the inside face of the side-pieces draw the lines *b–e*, *c–f*, $\frac{3}{4}$ inch from BE and CF, respectively. With the back-saw make saw-kerfs $\frac{1}{4}$ inch deep on each of these four lines. Be careful to keep your saw level while making these kerfs. With a chisel, cut out the wood between the saw-kerfs, to the depth of $\frac{1}{4}$ inch. Smooth the mortise with sandpaper stretched over a block $\frac{1}{2}$ inch thick. Do not sandpaper very much, just enough to remove the roughness. Now give the side-pieces a final smoothing with the plane.

Have hot glue ready, together with some slender brass screws, $1\frac{1}{2}$ inches long, with half-round heads. Across the outer faces of the two side-pieces, draw very faint pencil lines exactly opposite the center of the mortises on the inner side. There will be four of these lines. With the dividers, mark points for five screws on each of these lines. Now fix one of the shelves in the vise, end upward, and drill holes with the awl through the side-piece into the end of the shelf. Do this on each of the four lines. Set the screws upright in the holes just made, and start each into the wood with gentle taps of the hammer.

With the end of the shelf held upright in the vise, apply a thin coat of glue to the end only. Brush a little glue on the mortise of the side-piece, fit the mortise to the end of the board, and with the screw-driver drive the screws home. The gluing should be done as quickly as possible. If any glue oozes out on the shelf or on the side-piece, wipe it away with a cloth from which hot water has been wrung. Now fix the other shelf in the vise and fasten the side-piece to it in the same way. The side completed may now be placed on the bench, and the other side-piece fastened to the shelves. In doing this work, remember that the glue should be hot, and neither too thick nor too thin. When the glue has dried, you can give the shelf a coat of cherry or mahogany stain. A good way to support it against the wall is by means of two stout hooks, screwed into the wall which enter holes bored with the bit at the back of the shelf.

# WOODWORK FOR BOYS

In suggesting the following course of lessons in woodwork for young boys, the aim is not to teach them to be carpenters, nor merely to give them instruction in the use of tools, letting manual training stop at that point, but rather, to give them an appreciation of tools as a means to an end, to teach them the dignity of labor, and to stimulate the faculty of invention. In other words, the purpose is to make the work educational, not utilitarian. This does not prohibit the making of useful articles, of intrinsic value; but the mere making of objects, from the sale of which a profit might be derived, is no part of the plan.

To acquire dexterity of hand, it is necessary to use that member rationally, in work which compels it, in order to produce satisfactory results, to respond readily and accurately to the prompting of the brain. The hand itself is a tool, but so little employment is found for it, in theoretical education, that its possible usefulness too often remains wholly undeveloped. To encourage this needed development, manual training gives the hand definite and orderly work to do.

Before the boy undertakes to make articles of recognized utility, he should get some idea of the power of the hand under control. This will fix in his mind the fact that it is the hand that is to do the work, not the wooden or metal tool; and at the same time it will open up to him a new field of activity whose novelty cannot fail to appeal to him. The knife is selected as the first tool to be used, in manual training. A carpenter seldom uses a knife; the chisel is his favorite cutting-tool; but the knife is a better tool than the chisel for imparting dexterity, and while it does not take the place of the chisel in practical work, educationally it is of great importance. The knife is the primary form of cutting-tool; the chisel, the plane, and the saw are modifications of it.

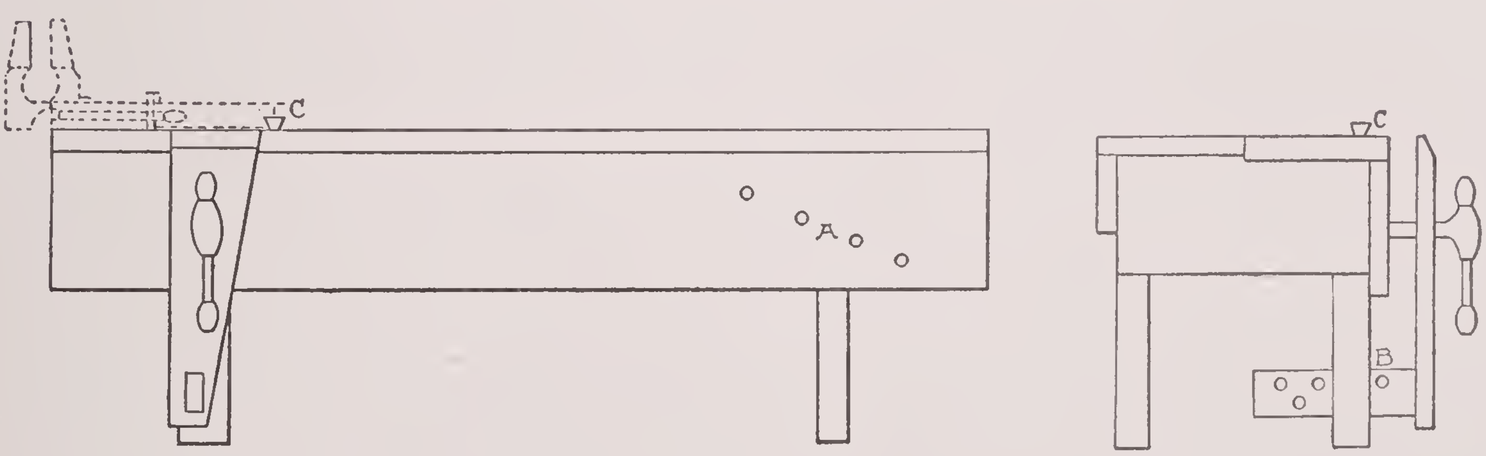
## TOOLS AND MATERIALS

In providing a set of tools for the beginner in woodwork, expense will naturally be taken into consideration. There need be no extravagance in making the necessary purchases, but it is well to remember in regard to tools, as in the case of nearly all other merchandise, that the best is always the cheapest, in the end. The tools

selected should be of the best quality; it is better to get along with a smaller number of excellent ones, than to invest the money available in the purchase of a greater assortment of tools of cheaper grade. The tools sold with the ordinary « boy's tool-chest » are mere toys, and are worthless for educational work. Saws that will keep their «set,» plane-irons that will not « nick » when they encounter slight obstruction in the wood, and chisels that will retain a keen edge for a reasonable length of time, give the young workman a chance to do his best. Inferior work must be expected when inferior tools are used

It is possible to make the assortment of tools larger than good judgment would dictate. Two or three chisels of different sizes are sufficient for the work that may properly be assigned to the beginner; to provide a dozen is to tempt him to change from one to the other without mastering any. As he becomes skilful enough to take up advanced work, he will desire additional tools; and these should be provided when actual need for them arises. If the worker has comparatively few tools, he learns to use them more skilfully and intelligently, in producing a given piece of work, than when he tries to find uses for a great variety of tools merely because he has them, and wants to see what he can do with them.

The wood-worker needs, first of all, a suitable bench, equipped with a vise and a rack at the back. Figure 1 shows the front and end ele-




Fig, 1

vations of a bench. The holes at A are for the insertion of a plug at different heights, in order that it may support one end of a long board when it is required to hold one on edge, in the vise. The holes at B show the method of changing the position of the lower end of the jaw of the vise in order to keep it parallel to the face of the bench, as pieces of different thicknesses are held in it, a device which is necessary to insure a proper grip on the piece of work to be held. At C is a bench-peg. This is to prevent a board from slipping along the bench while it is being planed. The bench-peg may be a stick of wood which fits tightly in a mortise, and can be driven up or down,

as desired; but a much better form is an iron "bench-stop," shown in Figure 2. This is sunk in a mortise so that the face D is flush with the surface of the bench. The stop E may be held at the desired height by the screw F.

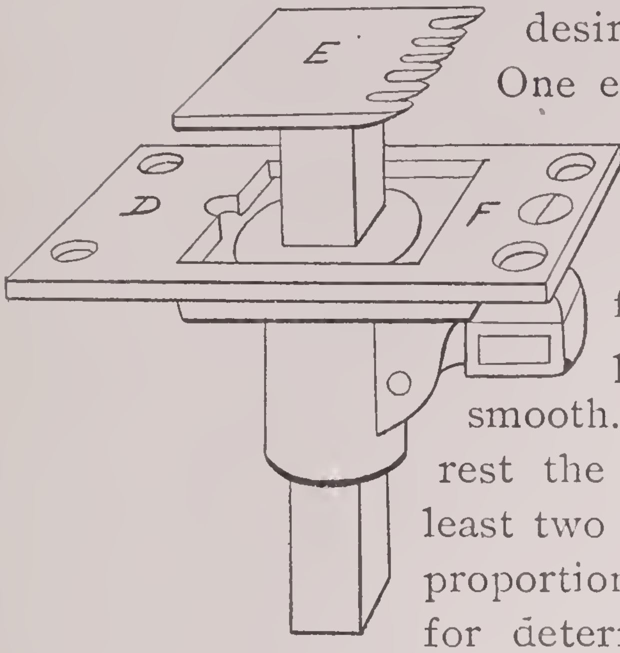


Fig. 2

One end of the bench should be open, as it will be found very convenient to have a projecting surface against which a piece of work may be held with a hand-screw, as in Figure 3, where a piece of work is held for chamfering. The outer edge is formed by a thick plank, selected with care, and made perfectly true and smooth. This affords a reliable plane surface on which to rest the work, and gives solidity. The bench should be at least two feet wide and six feet long. Its height should be proportioned to the stature of the worker. One rule for determining the height is that the top shall be just above the wrist, when the arm hangs naturally at the side. The bench should be oiled or shellacked, and care should be taken not to deface it.

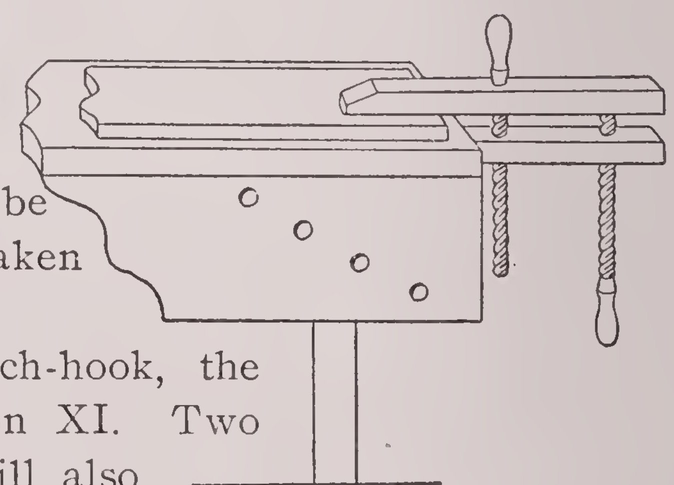


Fig. 3

One of the furnishings is the bench-hook, the making of which is described in Lesson XI. Two horses, or trestles, will also be needed, but after learning to use the saw and the plane, the wood-worker can make these for himself. The construction, which is simple, is illustrated in Figure 4. Two boxes of equal height may be made to serve, temporarily, in place of the horses.

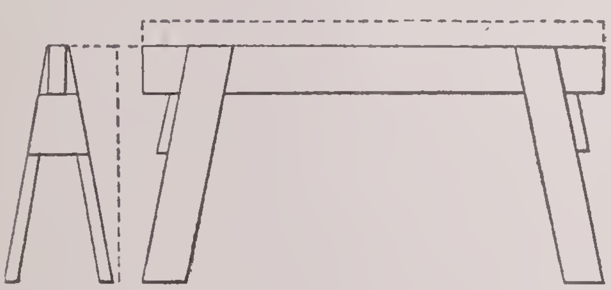


Fig. 4

In making up a kit of bench tools, the following list will be found a practical one. It is possible to get along without some of the tools listed below, but it is not considered desirable to do so: —

Strong pocket-knife, two blades, of the best steel.
Hatchet.
Marking-gauge, 8-inch.
Bevel, 8-inch.
Cross-cut saw, 20 inches long, 8 teeth to the inch.
Rip-saw, 24 inches long, 6 teeth to the inch.
Back-saw, 10 inches long.
Claw-hammer.
Mallet.
Try-square, 6-inch steel blade.
Compasses, adjustable for pencil.

Two-foot folding rule.
Straight-edge, wood, $\frac{3}{16}$ inch x 2 inches x 30 inches.
Jack-plane, stock of iron and wood.
Smoothing-plane, 8-inch, iron preferred.
Block-plane, 6-inch, iron.
Plow.
Brad-awl.
Four chisels, $\frac{1}{8}$-inch, $\frac{1}{4}$-inch, $\frac{1}{2}$-inch, 1-inch.
Two gouges, $\frac{1}{2}$-inch, 1-inch.
Draw-knife, 8-inch.
Brace.
Set of bits, including counter-sinker and screw-driver.
Screw-driver, wooden handle.
Nail-set.
Scraper.
Spokeshave.
Handscrews, two or more.
Grindstone.
Oilstone.
Oil-can.
Glue-pot.
Bench, brush, and dust-pan.

Glue, nails, screws, sandpaper, and oil will also be needed. The bench should be placed in a favorable position with reference to the light and trued up so that it will stand firmly in its place. It should be so placed that the operator can stand not only at the side, but also at either end of the bench, as desired. This will facilitate the training of both hands and help in the physical development of both sides of the body. The beginner should practise economy in the use of his materials, from the start. It is not well to have on hand too great a supply of lumber. A piece of wood spoiled is a piece wasted, and waste should not be encouraged by making it too easy to throw away a first piece of wood and replace it with a second from the stock. For the same reason, nails and screws should not be carelessly dropped and lost among the shavings. It takes but a few seconds to straighten a bent nail, and when straightened it will serve its original purpose as well as a new one.

A proper care for his tools and surroundings bespeaks a neat workman. The tools should have their individual places and be restored to them when not in use. The bench should have a back, against which may be fastened a rack for chisels, bits, etc. The saws should be kept in a dry box. When putting them away, after use, they should be freed from sawdust and rubbed with a drop of oil, which will prevent the rusting of the blade. Edged tools should be handled

carefully and not allowed to become nicked or dulled by striking against hard substances.

A few preliminary exercises in the use of the knife and the hatchet will make clear the importance of understanding the nature of wood, in order that the work to be done upon it may be done intelligently. The necessity of laying out the work, in order to avoid waste of time, labor, and material, is suggested in Lesson VI., on "Working Drawings."

## LESSON I.—KNIFE AND HATCHET CROSS-CUTTING

You may have seen a log split by means of wedges, which are inserted in a narrow crack and driven farther and farther into the log until they force it apart. A knife or a hatchet is a wedge and is forced into the wood to divide it. Take a stick of pine wood, three-quarters of an inch square and a foot long, and with your knife try to cut off a piece two inches long. Press the knife down on the wood, holding the blade across the stick. Although you press hard on the knife, you find that it enters the wood but a very little way, and you can make only a shallow notch in the stick, as at A in Figure 5. Yet the knife is sharp and the wood is soft. The reason the knife makes no greater progress through the stick is that the wood at the sides of the notch presses against the blade and prevents the knife from cutting deeper.

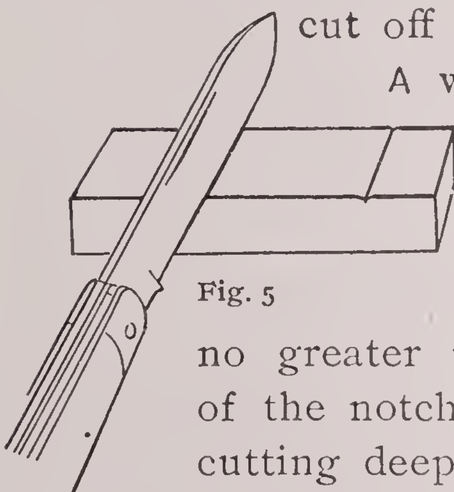


Fig. 5

The only way to make it possible for the knife to cut all the way through the stick is to cut away the wood at the sides of the notch, so that the knife can enter the wood a little farther, and continue this work until the stick is cut in two. But there is a speedier way to accomplish the same result. Instead of holding the knife-blade perpendicular to the surface of the stick, hold it at an acute angle, so that the back of the blade is slanted toward the near end of the stick, and push the knife into the wood. See Figure 6. It enters the wood more easily and penetrates farther than it did before, and the wood above the blade curls upward, as at A.

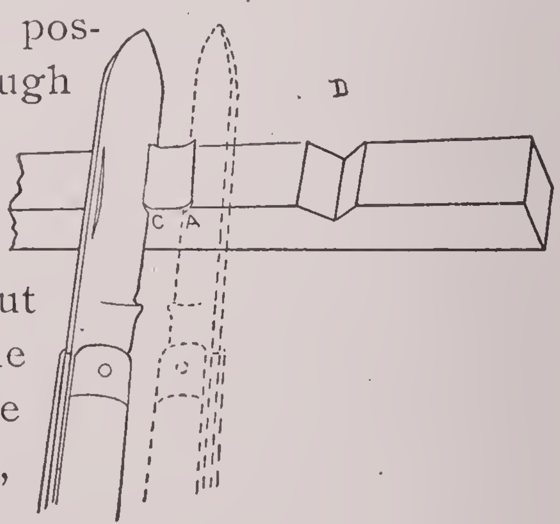


Fig. 6

Now hold your knife at the same angle, but with the back slanted toward the other end of the stick, and cut in obliquely, as you did before. The knife pushes through the wood to C, and again the wood curls upward. A little chip is formed, which drops out and leaves a wide notch in the stick, as at D. Now place the knife a little back of

the first cut and push it into the wood again. The wood curls upward much more readily than it did at first and the knife penetrates farther into the stick. Repeat the cut from the other side and another chip drops out. In this way you may continue to cut into the stick until you have reached its center. If you now turn the other side of the stick upward and repeat these cuts, the knife will again penetrate to the center and the stick will be divided.

This experience in cross-cutting teaches us that the knife or any other tool for cutting will not enter wood to any great depth if it is pushed straight downward. But you have seen that when the knife is pushed into the wood in an oblique direction and drawn along, it divides the wood quite easily. The reason for this lies in the formation of the wood. The fibers of the wood run the long way of the stick but they are not very tightly packed together. When you press directly down on them they can offer considerable resistance, but if you separate them from each other they yield more readily. When the knife enters the wood in a slanting direction, it is really separating the fibers from each other. If you try to cut into an old broom, by pressing straight downward, you may sever a few of the upper stalks of the broom-corn, but you cannot cut in very far. If you cut in a slanting direction, the stalks yield readily, and you can cut through the broom, if you wish, without difficulty. The fibers of the wood are laid one over the other, as the stalks of the broom-corn are laid, but are pressed more closely together. So it is plain that when you draw or slide the knife along, at the same time that you press down upon it, you can cut more easily than when you try to break the fibers by straight downward pressure, without separating them from each other.

Notice that when the cook cuts the bread, she slides the knife back and forth at the same time that she presses down on it, and so divides the loaf with ease. But if she presses straight downward, the bread does not divide readily and, at best, crumbles and breaks, leaving ragged, uneven edges which show that it was torn apart roughly. In due course we shall see how the sliding motion of the knife is applied in cutting wood with the saw, which is another form of knife.

When you have cut two or three pieces from the stick, holding the knife in the right hand, shift the knife to the left hand and make the same cuts as before. You should learn to use the knife as readily with one hand as with the other. Remember, whenever you use it, to keep the edge of the blade turned away from the hand that is holding the piece of wood you are cutting. If you pull the knife toward you, the wood may suddenly splinter, or the knife may

slip, and gash your hand. This rule applies to the other edged tools you will use in woodwork, as well as to the knife. Keep the edge turned away from you, and then it will not be likely to cut you, in case the tool slips, or if you fall while you have it in hand.

The stick you have been cutting is only three-quarters of an inch square, but suppose you take a stick three or four times as large — a piece of two by three inch pine, for example. You could cut a section from this with your knife, if you took time enough, but it would be a long and tedious job. Instead of using the knife, therefore, you will use the hatchet, which is really another form of knife. In using the hatchet, however, we do not press it against the wood, as with the knife, but strike blows with it. If you try to cut with the hatchet directly across the fibers of the stick, you will have the same experience as with the knife. It will enter the wood only a little way. But if you hold the stick so that the hatchet will enter the wood in a slanting direction, when you strike, you will find that it throws up a chip, as the knife did. By striking first from one side and then from the other, so that the cuts meet in the form of a V, you will be able to divide the stick with ease. In cutting with the hatchet, be careful to rest the end of the stick at or beyond the center of the chopping-block, so that if the tool glances or slips from the stick, it will strike the chopping-block and not swing around and cut you.

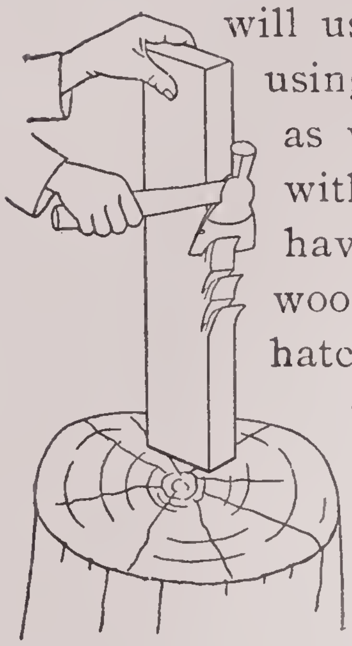


Fig. 7

From the use already made of the knife and the hatchet, we see that they are not well adapted for cutting straight across a stick of wood, for even if we adopt the plan of notching the wood, with cuts delivered first from one side and then from the other, we are obliged to waste some of the wood. Moreover, the pointed ends of the stick must then be finished square for ordinary uses. The proper tool with which to make a straight cross-cut is the saw, about which we will talk later on. But the knife and hatchet are very useful tools for making cuts of another sort. Let us see what these cuts are.

## LESSON II.—SPLITTING AND HEWING WITH KNIFE AND HATCHET

Take a piece of pine half an inch thick, three inches wide and eight or ten inches long, and with your knife try to cut from one edge a piece three-quarters of an inch in width, as AB, Figure 8. You press the knife-blade against the end of the stick, as at A. Press downward with considerable force and the wood is parted by the knife,

which acts as a wedge and a piece is separated from the stick. At the top, where your knife first entered the wood, the piece to be split off is three-quarters of an inch wide. You wished it to be of the same width throughout. But in splitting the wood, the knife did not follow a course parallel to the side of the stick. Instead, it went too far to the right and the piece you split off tapers to a point. Turn the other face of the stick toward you; place the knife against the edge, three-quarters of an inch from the side, as at C, and press downward as before. The wood divides again, but this time the knife goes too far to the left and the piece split off is wider at the bottom than at the top, as in Figure 9.

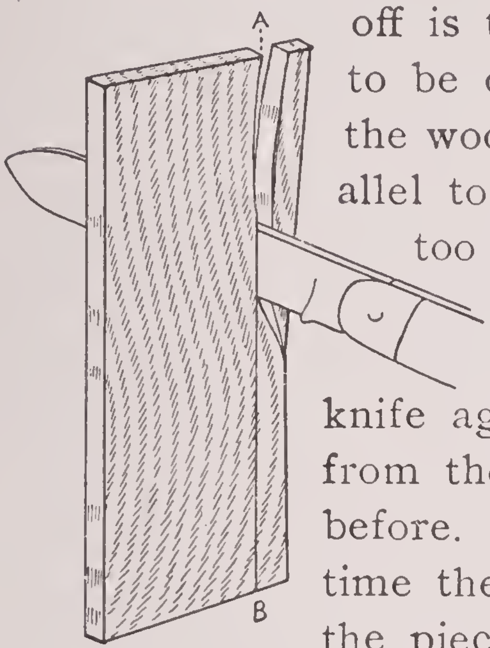


Fig. 8

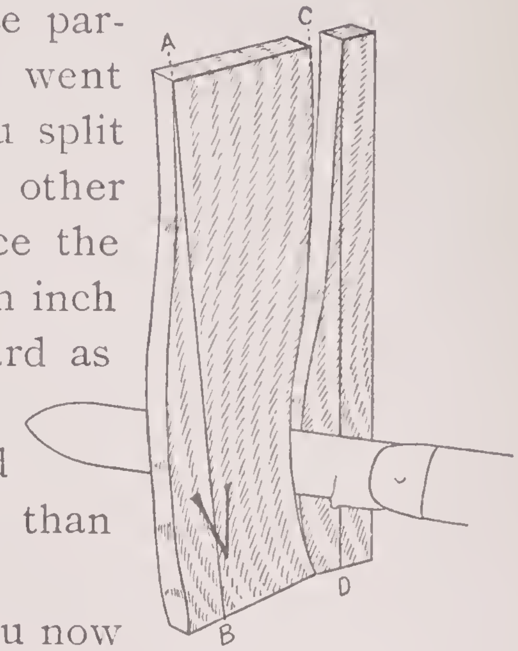


Fig. 9

By looking at the sides of the three pieces of wood you now have, you will see that the knife followed the grain of the wood. Examine the face of the wood and you will see the lines which indicate the grain, running obliquely through the wood. When you select another piece from which to split off a section of equal width throughout, look at the grain of the wood, and if it runs parallel to the sides of the stick, you will have no difficulty in splitting off a piece approximately of the same width at the bottom as at the top.

It may be that a straight-grained piece of wood is not available, yet it is necessary to have a stick with parallel sides. This can be obtained from the piece V. Take the straight edge and lay it on the face of the stick and with the pencil draw a line FK, as in Figure 10. You wish to trim the irregular side down to this mark. Notice how the grain runs, and begin to cut above F, and toward K, so that your knife will tend to turn outward. Pare away the wood carefully until you are down to the line. When you reach the point S, you will see that the grain turns inward and if you keep on cutting in the same direction you may split off too much at K. Turn the stick, therefore, and cut from K toward S. In this way you can make a straight edge. Draw a line LM, parallel to FK, and repeat the paring operation on that side. Your stick will then have straight sides and be of equal width throughout.

The experience you have had with the thin stick may be repeated in the case of the heavy stick, two by three inches square, on which you made cuts with the hatchet. In reducing the irregular edge to a straight one, you will find it necessary to cut off chip after chip until the line has been nearly reached. Then with light, even strokes,

smooth the edge. This is called hewing. Railroad ties are hewn in this way. In olden times, the heavy beams of houses and other buildings were squared and smoothed in the same manner, with the ax and the adz, which are similar to the hatchet in form and in the method of using them.

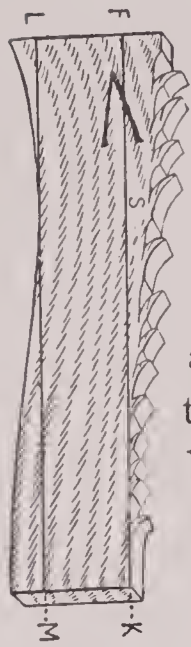


Fig. 10

If the grain of the wood is very irregular, it may be necessary, in using either the knife to pare, or the hatchet to hew, to a line, to "score" the stick several times with cuts made at an angle, as in Figure 10. The stick is then turned and the same kind of cuts applied in the opposite direction. This breaks up the fibers and prevents splitting.

Sharp tools are necessary in order to do this work well, and, in fact, all tools used in wood-working must be kept well sharpened, if good results are to be had from their use.

## LESSON III.—THE STRUCTURE AND STRENGTH OF WOOD

The experimental cutting of the pine stick with knife and hatchet has shown you that it is necessary to know something of the structure and strength of wood before you can work upon it with tools in an intelligent manner. In another volume of this work will be found extended accounts of the cellular growth of plants and trees. In this lesson we shall look at the structure of wood from the practical point of view, in order to understand it as lumber, rather than as a plant-growth.

Plants are made up of a succession of long or short cells and tubes. When the plant is young, these cells have soft walls and contain a substance which is almost fluid. As the plant grows older, the fluid contents of the cell become hard and fill the cell. When the plant is cut down and dried, these cells become harder, but at the same time they grow smaller. This is why timber shrinks in drying. When the cells, which are placed side by side, become hardened in this way, they form a woody tissue, and the hardness and weight of timber depend on the closeness with which the fibers, or hardened cells, are packed together. Trees are made up of these tissues or fibers.

A new layer of tissue is formed each year, between the bark and the pith or center of the wood, so we may know how old a tree is by counting the rings which appear on a cross-section of the trunk. As the tree grows older, the woody tissue near the center becomes

harder. This is called heart-wood. The outer layers, which are not so old and are therefore softer, are called sap-wood. (See Figure 11.)

When timber is cut from a tree immediately after it is felled, the wood is "wet," or full of sap. But by exposure to the air the moisture of the tree, or the sap, is evaporated and the tissues are packed more closely together. This is called seasoning the timber. Trees are generally felled in winter, when the sap runs least freely through them, and they are, therefore, in a condition to dry, or season, more quickly than if cut in the summer, when they are full of sap. If the unsawed log is allowed to lie on the ground, it takes moisture from the soil and decays.

Fig. 11

After a log has been sawed into planks, or boards, the boards must be seasoned. They are usually piled up in a place where they are sheltered from the sun and the rain, with sticks between them to allow the air to reach freely all parts of the board. We often see, in houses, door-panels that have shrunk and doors or windows that will not open and shut easily, because the stock from which they were made had not been sufficiently seasoned before it was used. The seasoning or drying process has continued after the doors and windows were put in place.

As it takes a long time for the natural seasoning process to do its work thoroughly, artificial means are sometimes employed. The boards are steamed, or dried in a blast of hot air. The term "kiln-dried lumber" is applied to wood which has been dried in this way. Such wood, carefully seasoned, is used in making fine cabinet work, where shrinking or warping would spoil the work. These artificial methods of seasoning, however, sometimes cause a change in the color of the wood or reduce its strength.

Shrinking and warping are drawbacks with which every wood-worker has to contend. It is well to understand why and how they take place. The sap of the tree is composed chiefly of water. While the tree lives and continues to draw moisture from the soil through its roots, and from the air through its leaves, the wood cells are filled with water. Then the tree is felled, and these sources of moisture are cut off. The water or sap already in the cells evaporates, little by little, and none comes to take its place. Then the walls of the cells fall in and all the fibers are packed more closely together. The wood really shrinks in all directions, but the shrinkage from top to bottom is very slight — so slight that it is hardly noticeable. The shrinkage from without toward the

center is more marked. In shrinking, the fibers sometimes separate from each other and cause cracks, which you will notice at the end of a log or of a board. As there is more moisture in the sap-wood than in the heart-wood, there is more shrinkage nearer the bark. The medullary rays, however, which radiate from the center of the tree outward, and are formed of hard plates, shrink very little. The shrinkage of the wood between these rays tends to draw the ends of the rays together, as in Figure 12, and this causes cracks. As wood shows a tendency to split along these rays, logs are often halved, or quartered soon after they are felled, to prevent cracking, as far as possible. Figure 13, *a* shows how a log may be split along the medullary rays, *b* the effect of shrinkage when it is quartered, and *c* the effect when it is sawed into boards.

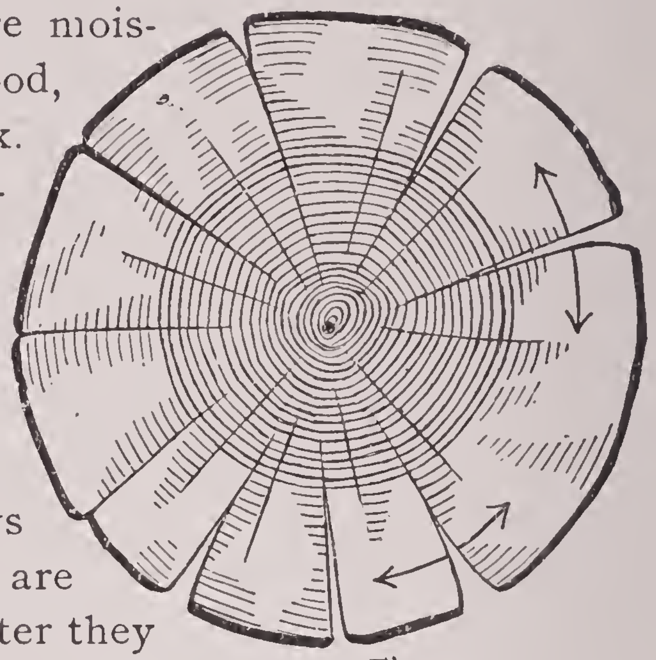
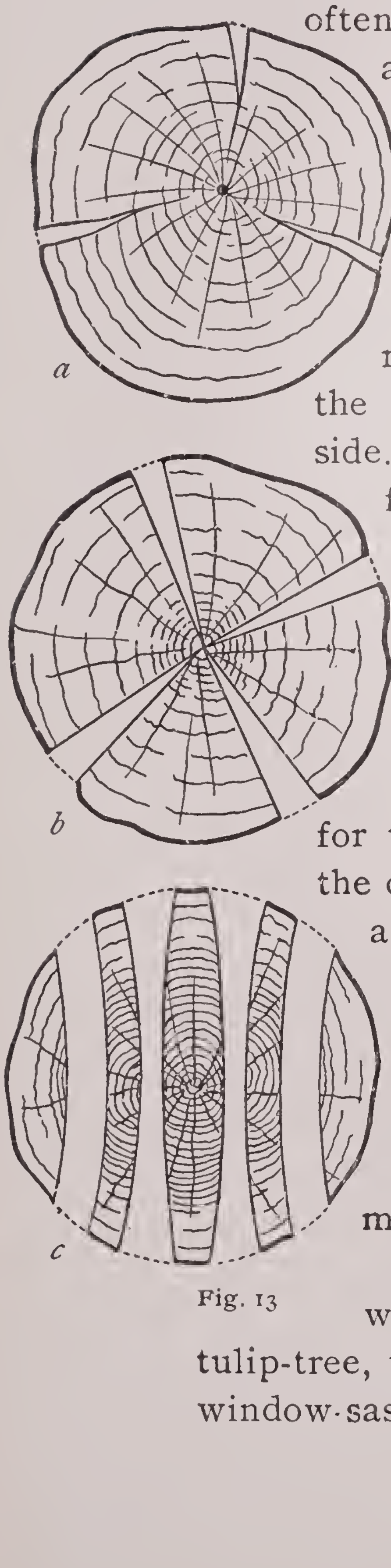


Fig. 12

When a log has been cut into boards, and for any reason one side of the board dries faster than the other, the wood becomes more closely packed together on the drier side. This hollows the board on the dry side and the wet surface becomes convex. We call this "warping." Seasoned timber which has been thoroughly dried will warp in the same way if one side becomes wet. This is one of the reasons why we take pains to keep our houses well painted on the outside. The paint fills up the pores of the wood and prevents the moisture from getting in.

Different kinds of timber have different characteristics, for the woody tissues are not alike in all trees. Pine is one of the commonest of the "soft" woods, or those in which the fibers are more loosely packed together than in the "hard" woods. There are many kinds of pine, and they differ from one another in formation, strength, and color. Generally, pine has a straight, even grain, is light and easily worked, and is inexpensive, in comparison with other woods, because it is more plentiful. It is not strong enough for work which must withstand great strains.



*a*

*b*

*c*

Fig. 13

"Whitewood" is not quite as soft as pine, but is easily worked and is in general favor. This wood comes from the tulip-tree, the basswood, the linden, etc. It is largely used for doors, window-sashes and parts of wagons and sleighs.

Elm has a closely-twisted grain, which makes it very strong. It lasts a long time even when buried in the earth or sunk in the water, and for this reason it is used in making coffins, the keels of ships, etc. It does not split easily, because of its twisted fibers, and keeps a firm hold on nails which are driven into it.

The chief characteristic of ash is its flexibility. It bends easily, and for this reason is not employed in building construction, but the same quality makes it valuable to the carriage-maker, who uses many pieces of curved wood. Ash may be steamed, and bent while hot, and if held in the bent position until it dries again, will retain its curved shape. The shafts of carriages are curved in this way.

Oak is the most durable of all timbers. It is one of the most useful woods employed by man, and for centuries has been chosen for work where great strength and durability were essential. It is very handsome when finished in oil or varnish, and in recent years has been used in enormous quantities for making furniture. Oak is tough, strong, hard, and flexible. Some kinds of oak are much more easily worked than others, which have a grain more or less twisted. Oak contains an acid that will corrode iron; hence it is preferably fastened together with brass nails and screws, or those made of galvanized iron. In ancient buildings, wooden pins were used for fastening parts of oak together. Oak trees grow to great size and live for hundreds of years, and the timber obtained from them is correspondingly durable. It is used in building ships, in making doors, posts, staircases, furniture, staves of barrels for liquors, and for many other purposes. When finished in oil or varnish it shows a beautiful grain. Oak varies in color from yellow and red to brown. It darkens with age and exposure. In very old houses may be seen doors, panels, and ceilings of oak, which have become almost black.

There are many other kinds of wood in common use, ranging from mahogany and ebony, whose beautiful color and fineness of grain make them especially suitable for elegant cabinetwork, down to the spruce, which is used for coarser work.

The proportionate strength of various woods may be accurately measured by testing-machines. These are used by builders, who need to determine accurately how much strain may be placed on timber without danger of breaking it. All timber is much stronger lengthwise than crosswise, because the fibers, singly or in bundles, resist powerfully any attempt to divide them by pulling at their ends, but separate readily from each other. To get a clear idea of this, split from a round pine-stick, five inches in diameter and ten inches long, which represents the tree, a section like LM, in Figure 14. You now have a short piece of board, and you can see that the grain of

the wood runs up and down the board, as in Figure 15. From the end of the board saw a section half an inch wide, like NO. Take this piece by the ends and pull as hard as you can. The wood will break. The grain runs the narrow way of the stick, and the short fibers may be pulled away from each other without difficulty. Now, split off a half-inch width of the board, the long way, so that you have the piece PQ. It is of nearly the same size and shape as the first piece. Take it by the ends and pull as before. The stick shows no signs of breaking, and try as hard as you will, you cannot divide it in this way. You could break it by bending it, but that would be the same as cutting across the fibers, and destroys the comparison.

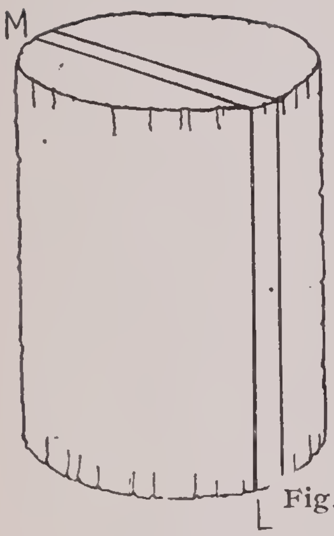


Fig. 14

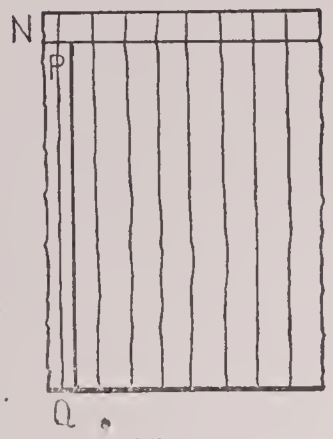


Fig. 15

So we see that while wood may be wedged or pulled apart without much difficulty, when the force is exerted in the direction of the shortest way of the tree, the same, or very much greater, force, exerted in the direction of the long way of the tree will have no effect whatever. In the first experiment, we pulled the fibers away from each other, just as we did with the knife and hatchet in the lesson on splitting. In the second experiment, however, we tried to break the fibers crosswise, with an up-and-down pull, and this we could not accomplish. The greatest strength of timber is found, therefore, in the long way of the wood — the way the grain runs; this is a fact which should always be remembered by the wood-worker.

As you advance in practical woodwork, you will find that a knowledge of these properties of timber is essential to success in constructing articles which will be substantial, as well as attractive to the eye.

## LESSON IV. — SAWS AND SAWING.

When you tried to cut squarely across the stick with a knife, you found that you could not divide it in that way and were forced to make a series of slanting cuts which formed successive notches. This wasted some of the wood and left the ends of the two pieces pointed. Again, when you tried to split the wood lengthwise, you found that it was difficult to split to a line, and a considerable amount of time was consumed in scoring, and paring, or hewing, the wood. It is necessary, therefore, to have a tool which requires less time for cutting straight across the stick or through its length in such a way as to leave a clean edge close to the line. The saw is the tool we use for these purposes.

The saw is a thin blade of steel, much longer than it is wide, notched or toothed along one edge, and fixed firmly in a handle which may be grasped easily. There are many shapes and sizes, and the teeth are very differently arranged for different kinds of work. But, however the teeth may be shaped, the saw is really another form of knife. If you look at the edge of a knife-blade under the microscope, you see at once that instead of being straight it is made up of a succession of very fine notches. You will remember, also, that you found it easier to cut into the wood when you drew the knife along with a sliding motion than when you pressed it straight downward. These two facts are taken into consideration in determining the form of the saw. It has large, regular notches, and the teeth are filed to a sharp edge. By pushing or drawing the saw against the wood, the teeth are enabled to cut the wood so as to form a succession of little notches. This breaks the fibers and divides the piece of wood into two parts, leaving a clean, true edge, without appreciable waste of material.

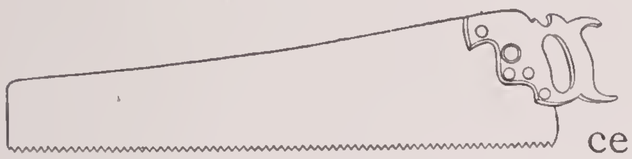


Fig. 16

The teeth of the saw are arranged according to the direction in which the wood is to be cut. The cutting-off saw, or crosscut-saw, is designed for sawing across the grain of the wood. In Figure 17, is shown the triangular shape of the teeth. Looking along the line of the teeth it will be noticed that one tooth is sharpened or beveled on the right side only; the next tooth is sharpened on the left side only. The teeth are thus sharpened, alternately, throughout the length of the saw. But the teeth are not in the same plane with each other nor with the blade of the saw. One is bent a little to the right, the next a little to the left, and so on, alternately. A little channel is thus formed between them, and if you place a needle between the teeth, near the handle, and raise the handle, the needle will slide between the teeth and drop out at the other end of the saw. This spreading of the teeth is called the « set » of the saw.

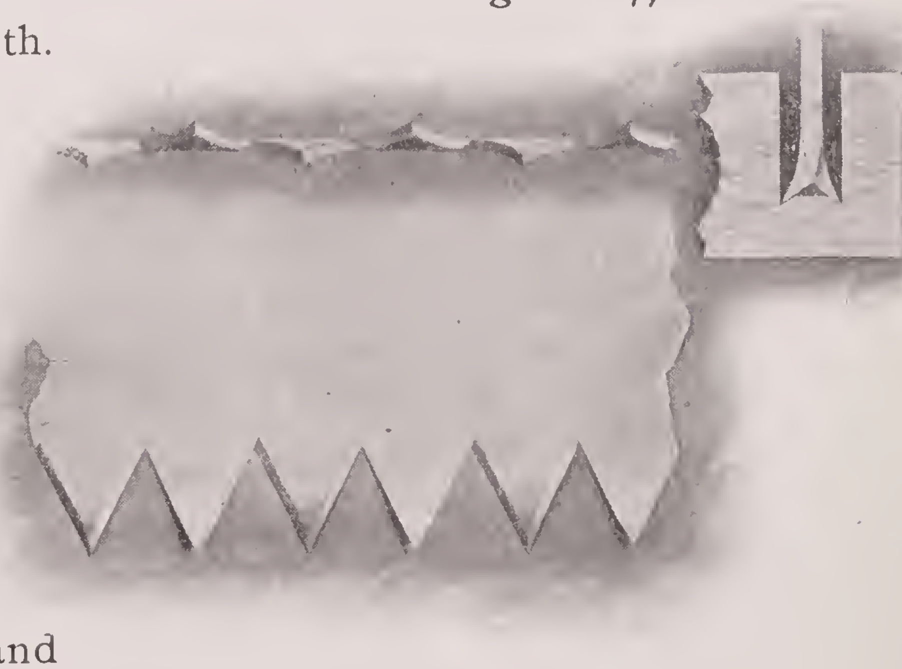


Fig. 17

Let us see why the saw, made in this way, can cut neatly through the wood when the knife fails to do so. When one of the teeth is pressed against the wood, it makes a little cut, as a knife might. The next tooth follows and makes another cut, but not in line with

the first, because the second tooth is bent away from the first. It makes, therefore, a similar but separate cut. The fibers have now been cut across at two points close together, which releases a little chip. This falls away, leaving an opening in the wood. Now comes the third tooth in the line of the first and as some of the wood has been cut away, tooth number three cuts farther into the wood. The fourth tooth follows in the line of the second, and a second chip is released. As the teeth have been bent, alternately, to the right and to the left, the path they make is wider than the blade of the saw. The advantage derived from this is apparent. As the saw penetrates deeper into the wood, the sides of the cut do not press against the blade of the saw and hold it back, as was the case with the knife; and as fast as the tiny chips, which we call "sawdust," fall away, the saw is enabled to penetrate farther into the wood. This is shown, in a purposely exaggerated form, in Figure 17.

The "set" of saws differs according to the character of the wood on which they are to be used. For soft wood, the teeth are set farther apart, and the path they make through the wood is comparatively a wide one; for hard wood, the teeth are not so much bent, nor so large, and they make a narrower cut. This cut that the saw makes is called the kerf.

The saw is one of the tools most frequently used in woodwork, and it is necessary at the beginning to understand how to use it correctly. Take a pine board, of any length, about six inches wide and three-quarters of an inch thick. Rest it on two horses or two boxes of equal height. If you are using undressed lumber, the end of the board will be irregular, as in Figure 18, showing that the log was felled with the ax. The end is also cracked or "checked," which shows that it has undergone shrinkage, as explained in the preceding lesson. The cracks extend in for two or three inches, and you desire a straight end free from cracks. Place the wooden side, or "beam" of the try-square A against the long edge of the board and let the steel blade B lie across the face of the board. Holding the beam firmly against the edge, mark with a lead-pencil, or with your knife, a line across the board, using the steel blade of the square as a ruler. This line should be far enough from the end to avoid the cracks.

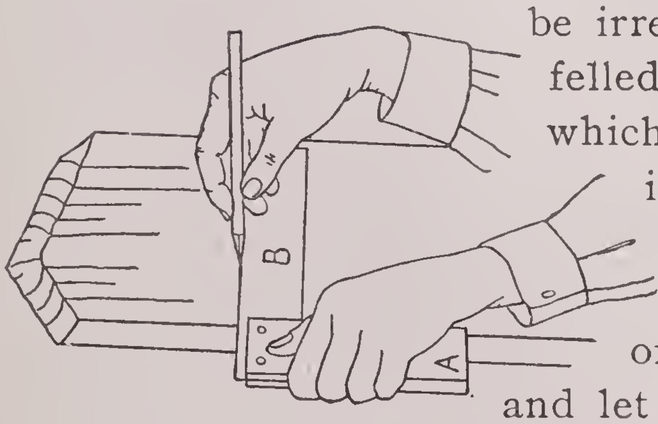


Fig. 18

Now take the cutting-off saw in your right hand, with the forefinger extended along the blade. Grasp the board with your left hand at the edge farthest from you and rest the toothed edge of the saw on the edge of the board so that the teeth come close to, but do not go beyond, the line you have marked. Use the left thumb-nail to steady the saw

in this position. The proper position for the hands and the saw is shown in Figure 19. Draw the saw backward, without bearing down on it, but taking care to hold it perpendicular to the face of the board, and the teeth will sink into the wood. This must be done slowly and carefully and the saw must not slip, else the edge of the board may be splintered. Your forefinger, pressing on the right side of the blade, will serve to hold the saw against the thumb-nail. When you have drawn the saw back nearly to the end, the teeth will have made a little kerf in the wood. Now push the saw forward and draw it back again, and repeat this action, taking care to keep the saw upright and close to the line. Do not bear down heavily on the saw. The teeth will cut through the wood of their own accord, when the saw is pushed forward, and if you bear down too heavily you may cause the blade to «buckle,» or bend, and the saw will leave the perpendicular.

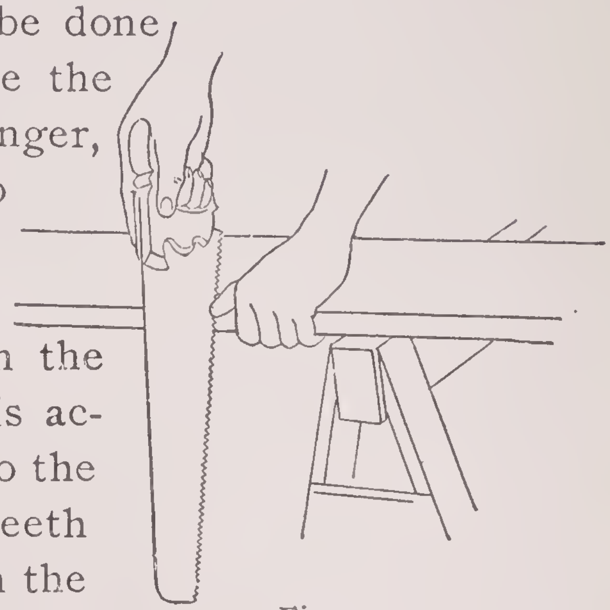


Fig. 19

Do not saw with short, jerky strokes, but at each stroke push the saw forward until the arm is extended in a straight line and draw it back until the hand comes near the shoulder. Do not draw it back so far that the forward teeth will be raised above the lower surface of the board. When the board has been cut nearly in two, support the outer end with the left hand and saw with very gentle strokes, so that the lower near edge may not be splintered by the sudden falling of the board by its own weight, before the wood has been cut all the way through by the saw.

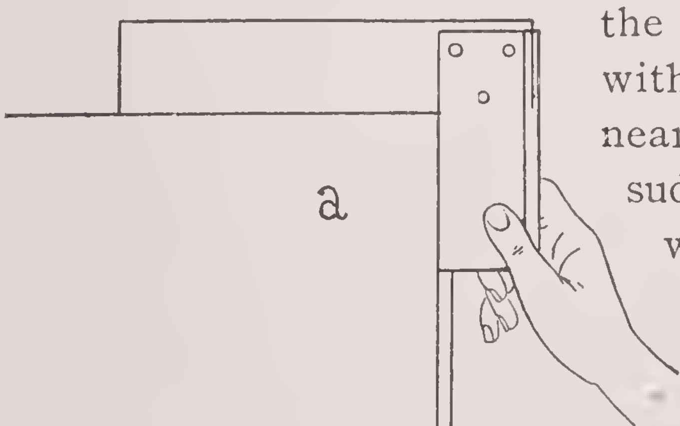



Fig. 20*a*

You now have a straight edge at the end of the board Place the try-square against the board, the beam resting on the near edge, as in Figure 20*a*, and see if you have sawed the board at right angles to the edge. Try it again by placing the beam against the edge of the board *b*, and see if the edge is perpendicular to the face. For practice, mark and saw off several strips, each an inch or two in width, and try the edge with the square each time.

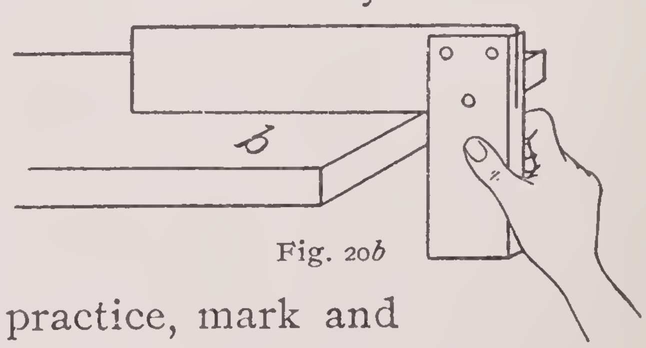



Fig. 20*b*

Remember that the teeth of your saw are sharpened and bent with great care, and the tool must be handled carefully if it is to remain in good condition. Do not throw it down anywhere, when you are done with it, nor let the teeth come in contact with iron or other hard objects.

You have been using the crosscut-saw to cut across the grain of the wood; but you will often need to divide a board on a line running the long way; that is to say, with and not against the grain. For this work a different saw is needed. It is called a rip-saw or splitting-saw, because it rips or tears the fibers apart, or splits them. In this saw, also, the teeth are triangular, but the triangles are not like those formed by the teeth of the crosscut-saw. In Figure 21, you will see the shape of rip-saw teeth. They are not beveled on the side, like the teeth of the crosscut-saw, but are sharpened so as to form a series of tiny chisels, and they have only a very slight "set," that is, they are not bent to the right and to the left as much as the teeth of the crosscut-saw. When this saw is pushed against the wood it separates the fibers from each other, and cuts out some of them altogether.

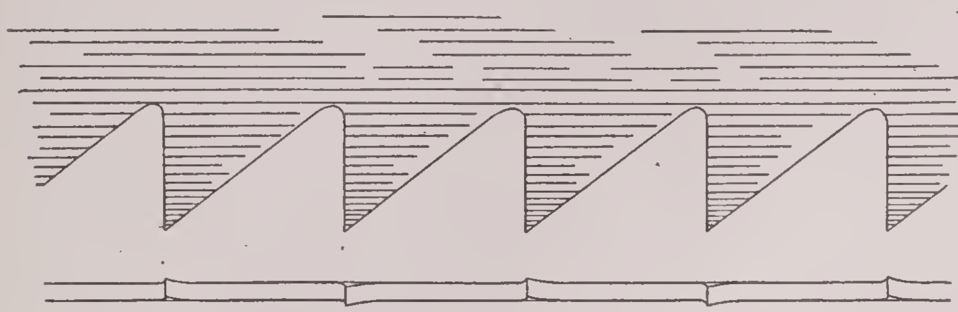


Fig. 21

You will need some practice in using the rip-saw. Take a board—the dimensions do not matter—and with your marking-gauge mark along one side a line two inches from the edge. The marking-gauge, Figure 22, consists of two parts: the stick, which is marked in fractions of an inch, and the block, which is mortised to receive the stick. A thumb-screw in the block makes it possible to hold the edge of the block firmly at any measure on the stick. The measure begins at the steel point which is inserted in the end of the stick. The steel point is not conical, but flattened, so that it will cut like a knife. Having set the gauge to the proper measure, you press the face of the block against the wood to be marked, and draw it toward you with the block tilted, as in Figure 23. If the pin is held in a perpendicular position, it will sink in too deep and tend to follow the grain of the wood, making an irregular line. If it is tilted, it will make a lighter line and cut across the grain, if necessary, thus making a straight line. When the first shallow groove has been made in this way, the pin may be pressed farther into the wood and the line strengthened by a second drawing. Having marked your board in this way, rest it on your horses or boxes and start the saw into the wood as you did with the crosscut-saw.

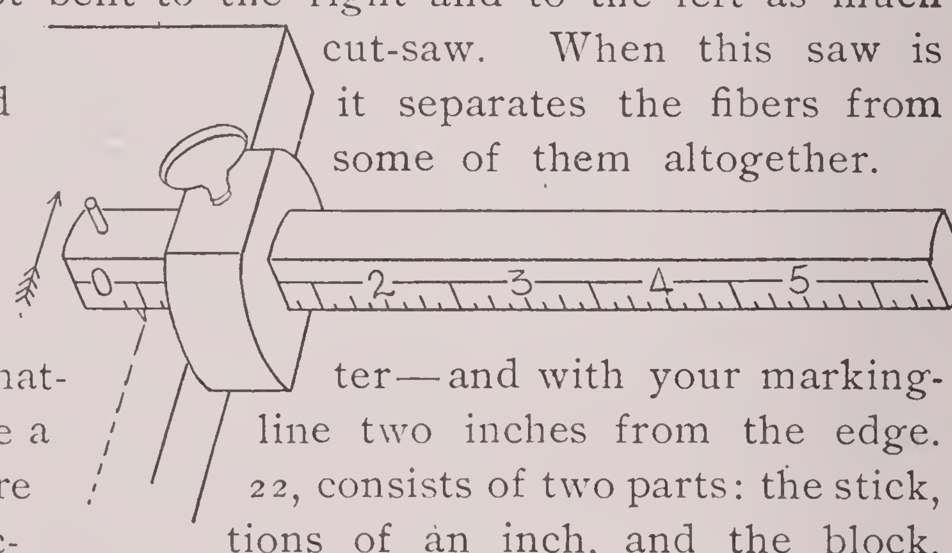


Fig. 22

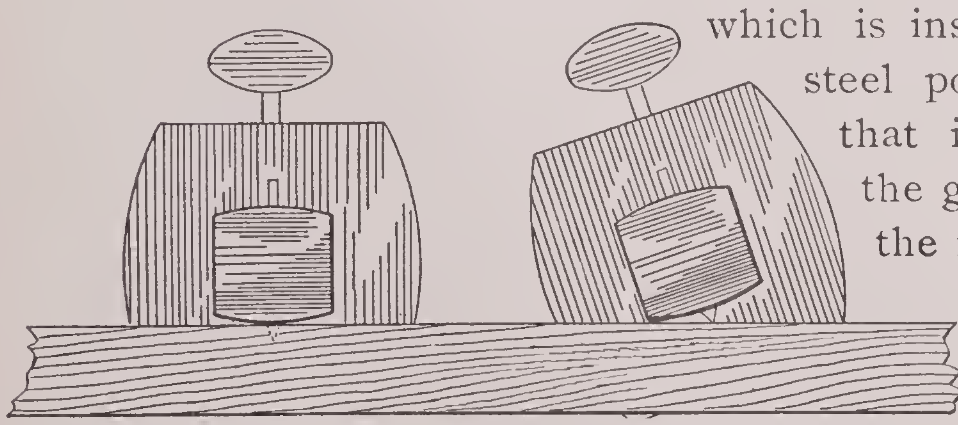


Fig. 23

Keep the saw close to the line. Do not bear down on it when you pull it toward you but exert some pressure upon it when you force it forward. The kerf made by the rip-saw is narrower than that made by the crosscut-saw, because the teeth are not bent so far outward, and the saw may show a disposition to bind or stick in the kerf. If you are sawing from the butt of the tree toward the top, the two parts of the board will be inclined to spread apart and will not bind the saw, but, when the saw progresses from the top of the tree toward the butt, the parts of the board will tend to come together, and thus pinch the saw. In this case, you can insert a screw-driver or a thin piece of wood in the kerf, not too near the saw, and so keep the two pieces of the wood wedged apart, as in Figure 25. As you saw farther into the board, the saw will approach the horse.

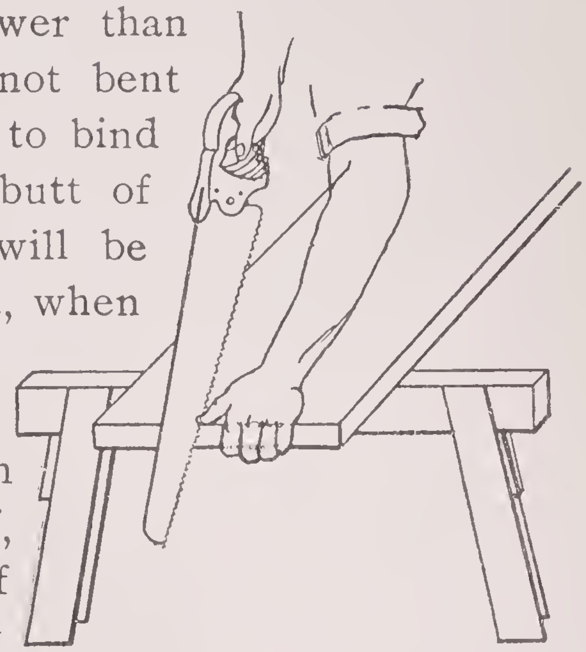


Fig. 24

In order not to cut into the horse, lift up your board and move it back, so that the part already sawed through will rest on the horse but the saw will be behind it, as in Figure 25. Follow the same plan when you approach the second horse. Move the wedge in the kerf nearer the saw as the work progresses, so as to keep the board spread apart. Do not take your saw out of the kerf until you have sawed the board to the end.

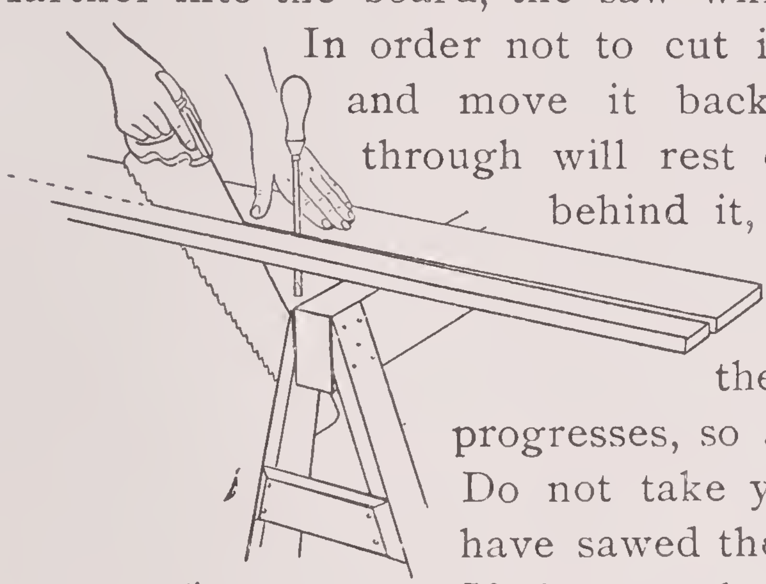


Fig. 25

If the saw shows a disposition to leave the line, bend it back toward the line, while sawing, and remember to keep it perpendicular, so that you will not make a beveled edge.

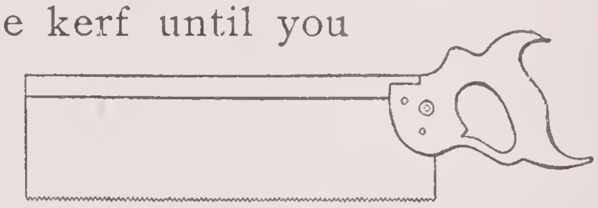
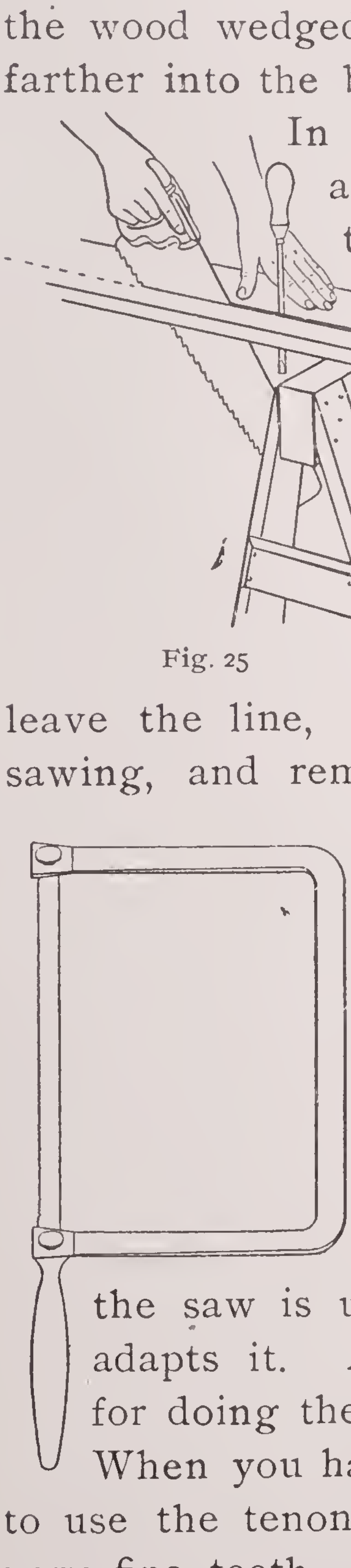


Fig. 26



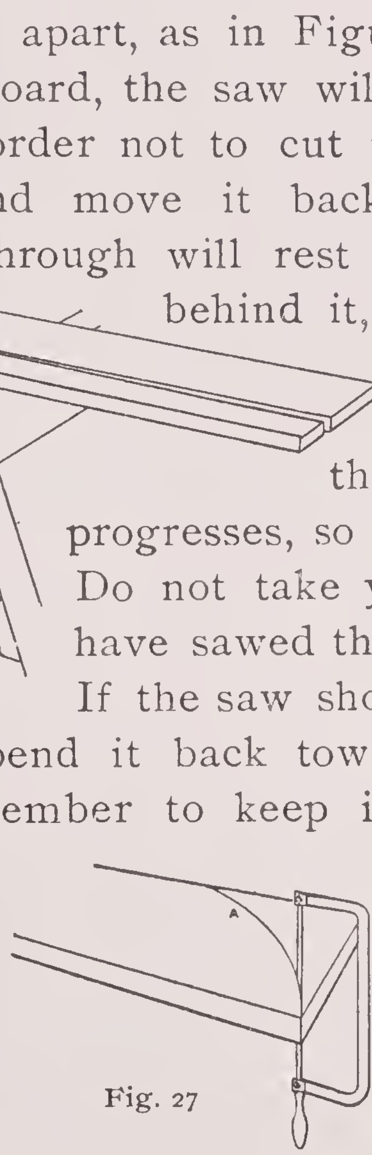
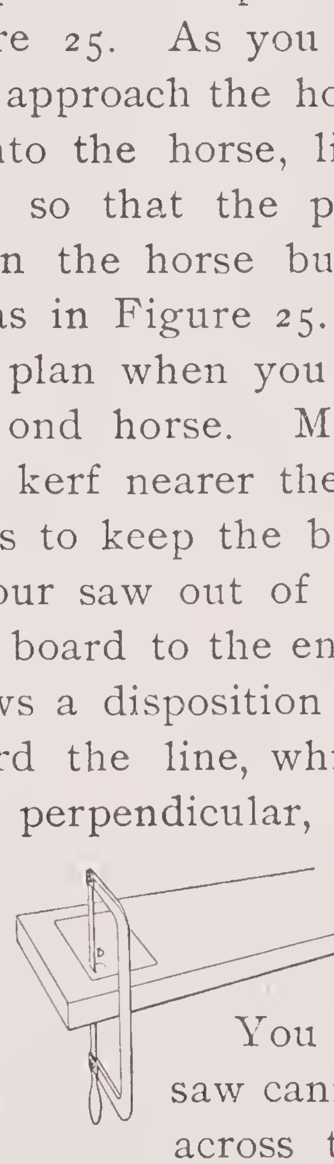


Fig. 27



You may ask if the rip-saw cannot be used to cut across the grain, and the crosscut-saw to split the wood. They may be so used, but the edges they make will not be so clean, and the work will be very much harder than when the saw is used only for the work to which its form especially adapts it. Always select a saw the teeth of which are formed for doing the work in the best manner, and most easily.

When you have made further progress in woodwork, you will need to use the tenon-saw and the dovetail-saw, which are back-saws with very fine teeth. There is also the frame-saw, which has a very nar-

row blade, with fine teeth, set in a frame as shown in Figure 27. This can be used for sawing on a curve, *a*, or within the board. In the latter case, a hole is made with the bit, and the saw, which is held taut in the frame by means of thumb-screws, is inserted in the hole, *b*. The compass saw is a saw with narrow blade (Fig. 28) used for sawing on curves and for cutting within the edges of the board, where a frame-saw could not be used. This saw is also called the keyhole-saw, as it is used for cutting out keyholes and similar openings. For the present, you will need only the cutting-off saw and the rip-saw, and when you are able to use these two dexterously, you will have no trouble in using the others.

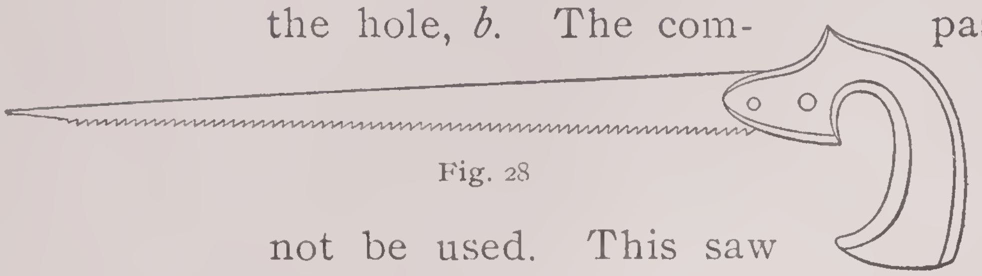


Fig. 28

In giving instructions for the use of the saw, you have been told to grasp it in your right hand, and to grasp the board with the left. The terms "right" and "left" are used merely to simplify the explanation. In practice, you should learn to use the saw with either hand. It is often very convenient to be able to do this, but there is a better reason for it in the fact that the use of tools in both hands, alternately, tends to an equal development of both sides of the body. A good sawer should be able to shift the saw from the right hand to the left, and *vice versâ*, while making a single cut, and to work equally well with either hand.

## LESSON V.—PLANES AND PLANING

The board on which you used the saw was a piece of ordinary "mill-dressed" lumber. When a log is sawed into boards by the circular saw, the surface of the board is left rough and shows the saw-marks. To remove these and reduce the roughness, the board is run through a machine called a planer, which "dresses" the surface, making it comparatively smooth, and of even thickness throughout. If the board is to be used for making work in which little value is placed on appearances, as in packing-boxes or in house construction, where the board will be hidden by other woodwork, it requires no further dressing. But if it is to be used in making something as conspicuous as a tool-box or a chest of drawers, for example, it will require to be smoothed still further. This smoothing is done by hand, with the plane.

There are many kinds of planes, as there are many kinds of saws, and each kind is adapted to a special use. All have, however, two principal parts, the stock and the iron. The stock is made of iron or of

wood. In the latter case, it is made from a block of very hard wood, like boxwood or beech, which has been thoroughly seasoned and is carefully finished so that the bottom, or sole, is a perfectly plane surface. In the stock a mortise extends from top to bottom, to admit of the insertion of the plane-iron. The plane-iron is sharpened at the end like a chisel. It is placed in the mortise, or socket, in the stock, in an oblique direction, the cutting edge pointing forward, and is secured in place by a wedge driven in above it. The socket ends at the bottom of the plane in a narrow slit, called the mouth, through which the plane-iron projects for a small fraction of an inch.

When the plane-iron is forced against the wood, it makes the same kind of cut that was made by your knife, when held in a slanting position, as in the first lesson. But the iron must be prevented from going too deep, and splitting off too much of the wood. You now see why it is held in a stock. The stock is pressed down upon the board and prevents the iron from going in too far. Now, when the plane is pushed against the wood, it tears up a thin shaving, which enters the mouth of the plane and passes up into the socket. But, although the stock of the plane prevents the plane-iron from entering the wood too far, the shaving or splinter, once started, might extend into the wood deeper than is desired and choke the mouth of the plane, or break, leaving a rough place and a considerable hollow in the board. To prevent this, the plane-iron is provided with a back-iron, or cap, which is a blade of about the same width and thickness as the plane-iron itself. This cap-iron is fastened to the plane-iron by means of a nut and screw. The lower end is bent upward, and the lower edge rests on the plane-iron a sixteenth of an inch, or less, or more, from the cutting edge. When the shaving passes through the mouth of the plane, it encounters this cap-iron, which causes the shaving to bend forward and crack. This crack is repeated as fast as the shaving is pushed upward, and the shaving is thus made very weak. If you examine a shaving carefully, you will see the little cracks across it which have been made in this way. The result is that the shaving has no lifting power and cannot tear up the wood beyond the desired depth.

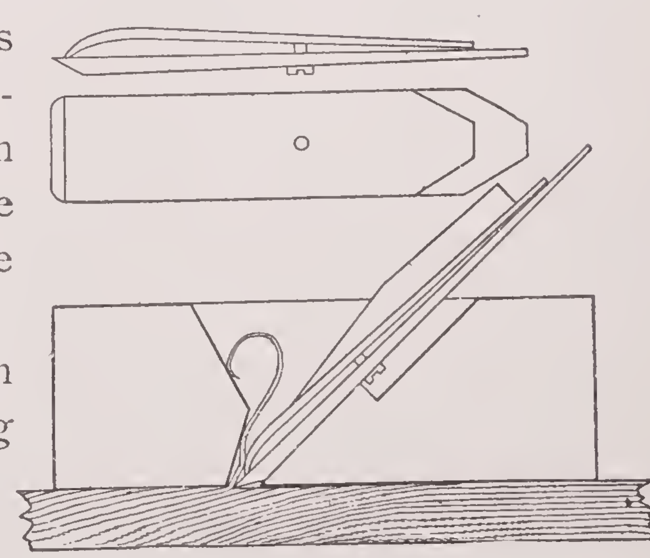


Fig 29

Your first attempt at planing may be made with the jack-plane, since this is the tool used for planing rough surfaces. The iron of the jack-plane has an edge which is slightly curved, as in Figure 29. If the edge were perfectly straight, and at right angles to the side of the iron, each stroke of the plane would produce a hollow with perpendicular walls. But as the edge is curved, the

shaving taken off is thinner toward the sides than it is in the center, and thus tears off easily, while in the first case it would be much harder to remove it.

Before you begin to use the plane, take it apart, so that you may see exactly how it is adjusted. If the plane-iron is held in place by a wooden wedge, tap the plane on the heel with a hammer, which will loosen the wedge. You can then remove both wedge and plane-iron. If the wedge is of iron and held in place by a spring, you will readily see how to take it out. You can now examine the plane-iron and notice the curved edge, and the back-iron. Replace the iron in the socket, with the beveled side downward, and insert the wedge. Now turn the plane over so you can glance straight along the sole. Do not allow the plane-iron to project too far beyond the block. Even if you have to readjust it and push it farther out, after trying it in use, it is better not to have it project far at first. Be sure that the edge of the plane-iron is at right angles to the side of the stock, that is, it must not be higher at one end than at the other, or it will make a beveled cut. Having secured it firmly in position, by means of the wedge, you are ready to use it.

Place your board flat on the bench, with the end resting against the bench-peg, which must be lower than the surface of the board. Brush off any dirt there may be on the board, so that it cannot dull the edge of the plane-iron. Stand near the rear end of the board, with the right side of the body near the bench, and the left foot forward. Grasp the handle of the plane firmly with the right hand, extending the forefinger as you did in grasping the saw. Place the left hand on the toe, or forward part of the plane, as shown in Figure 30. Resting the sole of the plane on the board, at the edge nearest you, push the plane forward with the right hand and at the same time bear down, but not too heavily, on the toe of the plane with the left hand, so that the sole will lie flat on the board. If you do not hold the toe down with the left hand, it will have a tendency to jump upward, the plane-iron will enter the wood too far below the surface, and this will make the shaving thick at first and then thinner, leaving a rounding surface on the board.

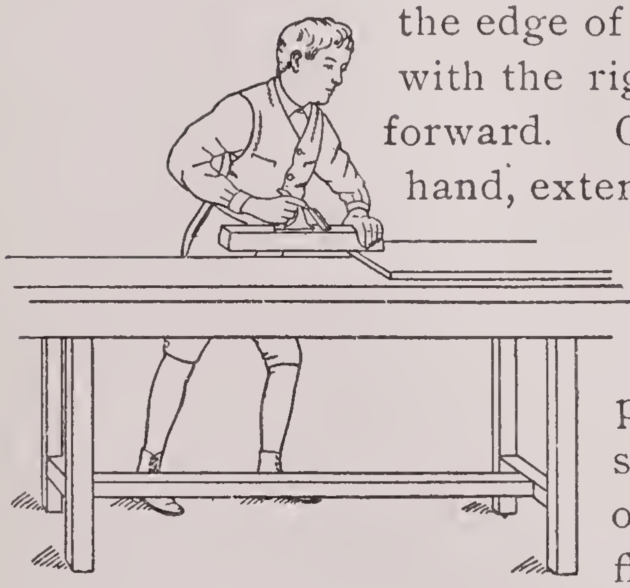


Fig. 30

When the plane nears the farther end of the board, lighten the pressure of the left hand, though still grasping the toe with it, and bear down more with the right hand, so that the heel of the plane may not be tilted upward. In the latter case, the iron would cut in too deep and you would again have a rounding surface. Generally speaking, you must plane *with* the grain of the wood, not against it, and, where the grain alters its direction frequently, it may be neces-

sary to turn the board end for end in going over certain portions of the surface. Take as long a stroke as you can, and do not shift the position of the feet unless the board is a very long one, so that you cannot push the plane to the end without changing your position. When you have planed to the end of the board, on the near edge, move the plane to the right and repeat the action. Do this until the entire surface of the board has been planed. You will now find that you have reduced the roughness and given the board a fairly smooth surface, but it is not a plane surface. Move the blade of the try-square along the surface of the board, and you will see that the surface is made up of a succession of hills and valleys. To get a smooth and plane surface the board must be planed again. For this work you will use the smoothing-plane.

The jack-plane itself is sometimes used for smoothing. The plane-iron is readjusted so that it projects very slightly from the stock, and can, therefore, take up but a very thin shaving. The cap-iron is also readjusted, by means of the screw, so that it comes very near the cutting edge. The curved edge of the plane-iron will still make hollows, but they will be shallower than those made by jack-planing, and will tend to produce a more even surface.

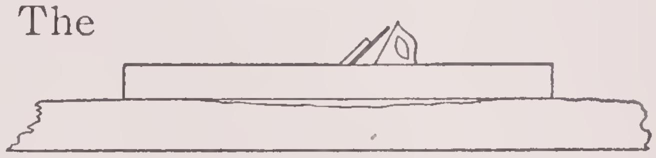


Fig. 31

But the jack-plane is not the tool generally used for this work. On large surfaces a fore-plane is employed. This is a plane with a long, heavy stock, and an iron shaped differently from that of the jack-plane. Instead of being curved, the edge of the iron is straight, except that at the sides it is slightly rounded, as in Figure 32. The fore-plane is used in the same way as the jack-plane, but it takes off thinner shavings and leaves a square, not a hollowed surface. The fore-plane thus acts as a smoothing-plane, but for finishing small surfaces you will use the smoothing-plane proper.

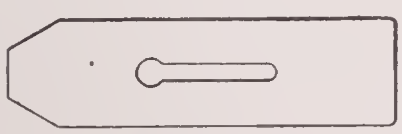


Fig. 32

The smoothing-plane has a short stock and is without a handle. It is grasped with the hand, from the top, the thumb being on the left side and the fingers on the right. As it is short and light, this plane may be used for taking short, quick strokes. It takes off but a thin shaving, and as it may be easily pushed in any direction, it is very useful in removing the ridges left by the jack-plane, and the roughness where the jack-plane was pushed against the grain of the wood. When you have carefully dressed the surface of your board with the smoothing-plane, it will be as nearly smooth as you can make it without the use of the scraper or sandpaper. Of the use of these you will learn something in another lesson.

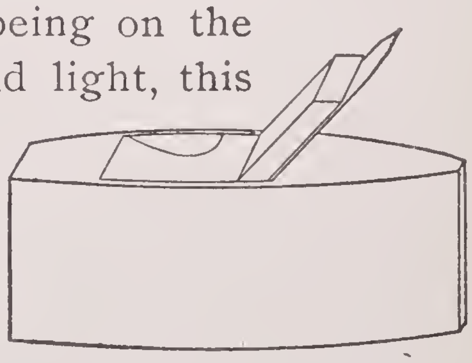


Fig. 33

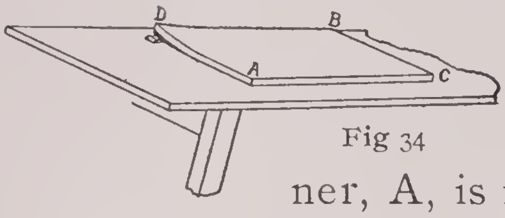


Fig 34

It will sometimes happen that you have a board one inch thick which you wish to reduce to a thickness of three-quarters of an inch, or it may be that you have a "winding" board, which is so warped that when placed on a plane surface, only three corners touch the support; the fourth corner, A, is raised a little from the bench. (See Figure 34). A board in this condition is not suitable for good work, such as making a neat box. You must be able to reduce it so that it will lie flat on the bench and touch at all four corners.

Put a chip under A, so that the corner will not be depressed when you bear down on the board with the plane. Now take the jack-plane and, beginning at D, make first a short stroke, then a longer one, and so on, toward B. Begin at D each time and let the last and longest stroke reach nearly to B. If you now apply your straight edge to the surface, you will see that it is nearer to being plane. Continue with the jack-plane, moving a little farther toward AC each time, and testing with the straight edge after every few strokes, until you find that the "winding" has been removed from that side of the board. Dress it with the smoothing-plane, and you will now have a surface that will touch the bench at all four corners. In other words, it is plane. But the board is now thicker along AC than it is on the side BD. You wish it to be three-quarters of an inch thick throughout its length. Set your marking-gauge to a measure of three-quarters of an inch. Now, hold the board on edge. Hold the marking-gauge in your right hand, and press the block against the surface you have smoothed. Draw the gauge toward you, being careful to keep the block pressed closely against the face of the board, and in this way mark a line all the way around the board. Press the pin into the wood very lightly. It will make a tiny groove in the wood. When you have marked once around the board, go back to the starting point and repeat the operation. The groove already made will guide the point and you can now press harder, so as to make a deeper line, which will be readily seen.

Now, place the board, smooth surface down, on the bench, and with the jack-plane go over the surface to reduce it to the mark made by the gauge. Be careful not to take off too much on the side where the board is thinnest, or to plane below the line marked. Finish with the smoothing-plane. Now test your board with the straight-edge, and if you have planed to the mark, all parts of the board will be of equal thickness, and it will be free from "winding." The edges, however, will not be at right angles to the surfaces, and it is necessary to true them. Put the board in the vise and plane one edge smooth and true. Be careful to have it at right angles to the surfaces of the board throughout

the length. Having secured one true, square edge, set your marking-gauge to the measure you wish, and then, pressing the block of the gauge against the trued edge, draw it toward you, and make a very light mark, as before. It will be hard to make a straight mark when the pin is so far from the block, and with the left hand you may steady the end of the stick that contains the pin. Move the gauge, and press the block against the board, with the right hand only. You now have a mark to which you can plane. Do this very carefully. Your plane must not be tipped forward nor backward nor over either side of the edge.

The board is now finished as to face and side edges, but the end edges are yet to be made neat and smooth. With the beam of the try-square pressed against the side of the board, see if the end is at right angles to the side. If it is not, mark a line and saw close to it, so as to obtain a square end. This end is, however, more or less rough. To make it smooth, fix the board in the vise, with the end upward, as in Figure 35, and plane it with the block-plane, which differs from other planes in having the iron inserted with the beveled side uppermost, so that, when it is driven against the wood, it acts precisely as a chisel would. The iron is also held at a much greater angle from the sole than in the case of the jack-plane, for the wood to be cut with it is made up of the ends, not the long surface of the fibers, as is the case when the jack-plane is used. Heretofore you have pushed the plane straight forward along the wood; now you start it at an angle, as in Figure 36. Push it against the wood very carefully, with short, quick strokes. If you allow the plane to go too far it will splinter the edge, by separating the fibers from one another as it did when you used your knife in splitting. By planing first from one side and then from the other, you avoid such accidents. Have a care to hold your plane squarely on the end of the board, or you will make a curved end, instead of a square one. This concludes the dressing of the board, and it is now ready for use.

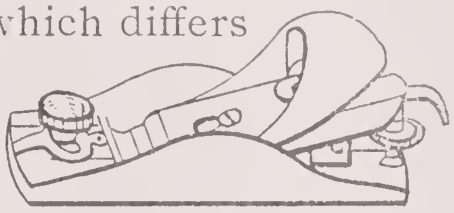


Fig. 35

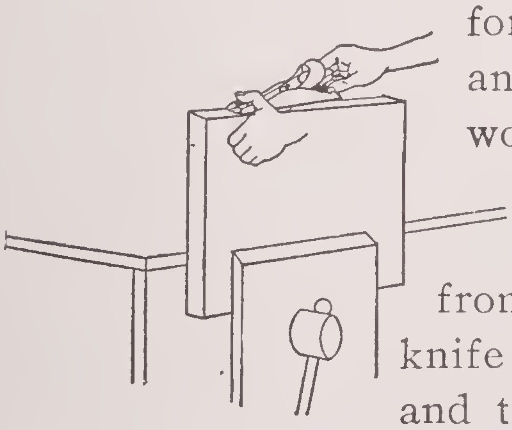


Fig. 36

Among the things you should remember in using the plane is that, after pushing it forward, you should tilt it on one edge, or lift the heel, before drawing it back to the starting point, as in Figure 37. This is to prevent the plane-iron from resting on the wood and so dulling the edge when it is drawn back. Another thing to be remembered is that the plane-iron must be examined from time to time, to

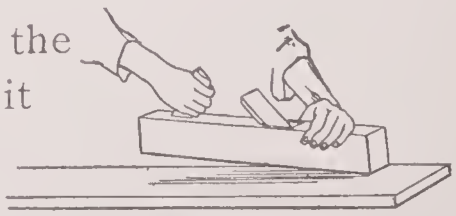


Fig. 37

make sure that it has not been pushed out of place, so that one side is higher than the other. This is likely to occur when the iron strikes a hard knot in the wood, if the wedge is not driven in tight enough.

Remove the shavings from the socket of the plane, frequently, and do not let them clog the mouth. If you find that shavings slip between the plane-iron and the back-iron, the screw that holds the two blades together should be tightened so that no shaving can pass between them. If you start the plane and too thick a shaving is torn up, so that the wood is splintering, do not try to mend matters by forcing the plane forward still farther, but withdraw it carefully. Then set the plane-iron so that it will not project so far from the stock, and plane from the opposite direction until the partially raised splinter has been planed away. Do not force your jack-plane against hard knots. The knot presents a surface where the ends of the fibers are upward; that is, you must cut against the grain. A block-plane or a smoothing-plane or the scraper must be used to reduce the surface of the knot. Generally speaking, you will avoid using lumber that is knotty, and lay out your work so as to cut out those sections of the board in which they appear.

## LESSON VI—WORKING SKETCHES AND DRAWINGS

You have now learned the use of the saw and the plane in reducing the lumber to the desired length, breadth, and thickness, and giving it a smooth surface. Before you proceed to construction work, however, you should know how to plan your work, and, having planned it, you should execute it according to the plan. In woodwork we cannot expect good results from guessing; we must know how to do a thing so that the result will be an exact counterpart of the article we can see, in imagination, as the finished product.

You decide to make a box. You can see a mental picture of such a box as you desire to make, but this mental picture is not an accurate guide for the tools which must be used in the actual work of construction. You therefore need a diagram, or a working sketch, as it is called, on which you can mark the several dimensions of the box in figures. With this to aid you, you will be able to cut out pieces of wood whose dimensions will correspond to those marked on your diagram, and if you make them with accuracy, they will fit together neatly and the desired result will be accomplished.

The box is to be fifteen inches long, eight inches wide, and seven and one-half inches deep, outside measurement, and it is decided to

make it of boards three-quarters of an inch thick. First draw a rectangle, like Figure 38, to represent the front elevation of the box. This will be a freehand drawing with a pencil, made on a piece of paper. In drawings of this kind, the mark (′) is used to represent feet, and the mark (″) to represent inches. On the upper line, therefore, you mark 15″. The sides will be less in width than the outside depth of the box, by the sum of the top and bottom thicknesses, which equals $1\frac{1}{2}$″. On the side lines, therefore, mark 6″. This shows that there will be needed two boards, each 6″ x 15″, for the sides of the box.

You now draw the plan, or a figure, to represent the bottom of the box. As the bottom will be nailed to the sides, and the outside measurement of the end must be 8″, you will see that the bottom must be 8″ wide and 15″ long. Draw another rectangle, as in Figure 39, and mark these dimensions on it. Mark it, also, « Plan.»

Now we come to the end of the box. If this were to be nailed to the ends of the sides and bottom, it would need to be 8″ wide and $7\frac{1}{2}$″ deep. But the box will be much stronger if you place

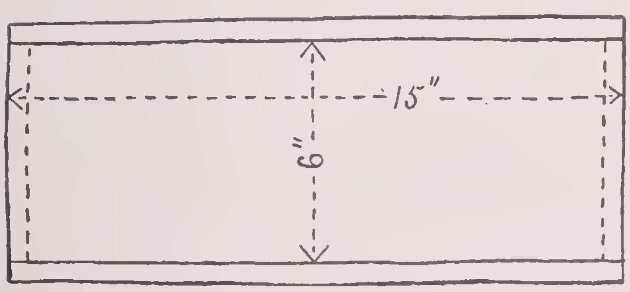



Fig. 38

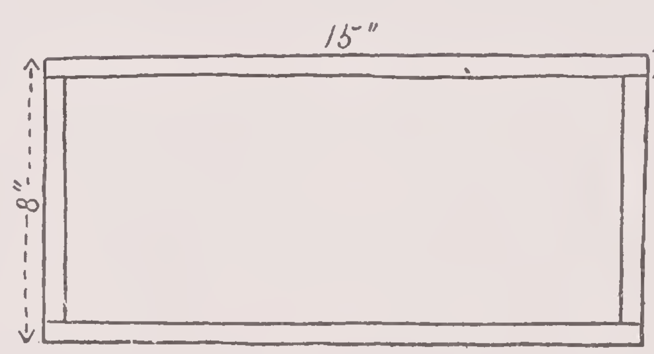



Fig. 39

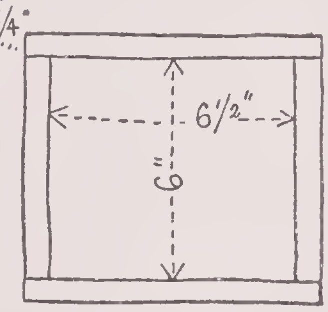



Fig. 40

the end board between the sides and nail into it from the sides and the bottom. This makes it necessary to have end-pieces of the same width as the sides, *viz.*, 6″ and $1\frac{1}{2}$″ less in length than the width of the bottom. Draw a third rectangle, Figure 40. Mark the sides 6″ and $6\frac{1}{2}$″, respectively. Mark this rectangle, « End.»

The top of the box must be large enough to extend to the outer edges of the sides and ends when they are in place, because the nails are to be driven down through the top into the sides. You will not need to draw another figure to represent the top, because that is to be a duplicate of the bottom, represented on the plan.

All these drawings should be made without a ruler, and quickly, their lines being in approximate, not necessarily in accurate, proportion to the proposed dimensions of the box. You now have three drawings which represent the boards to be used in making the box, and these drawings have been marked with figures to indicate the dimensions of the boards. From this working sketch, as it is called,

you will be able to work your boards to the dimensions indicated, using measure, try-square, gauge, saw, and plane. When completed, the pieces should fit together in the manner indicated so as to make an oblong rectangular box, 15 inches long, 8 inches wide, and $7\frac{1}{4}$ inches deep, outside measurement.

As there might be a doubt whether the figures on a sketch referred to inside or outside measurement, it is customary to draw a dotted line with arrowheads at the ends, to indicate the points to which the line extends, and to mark the number of feet or inches on this line.

A working drawing differs from a working sketch in that it is drawn accurately to a scale; that is, if the scale is 1 to 4, a line in the drawing which is one inch long will represent a measurement of four inches on the object to be made. The lines of a working drawing are made with a ruler as a guide, are carefully measured, and must be so accurate that, if we simply make the drawing and mark on the margin of the paper "Scale $\frac{1}{4}$," a workman, by measuring each line in the drawing and making the corresponding line on his work four times as long, could produce the article in exact dimensions, as required.

Instead of marking the drawing, "Scale $\frac{1}{4}$," we may say "Scale $\frac{1}{4}'' = 1''$," to show that a quarter of an inch on the drawing represents an inch on the object to be made. Another method is to

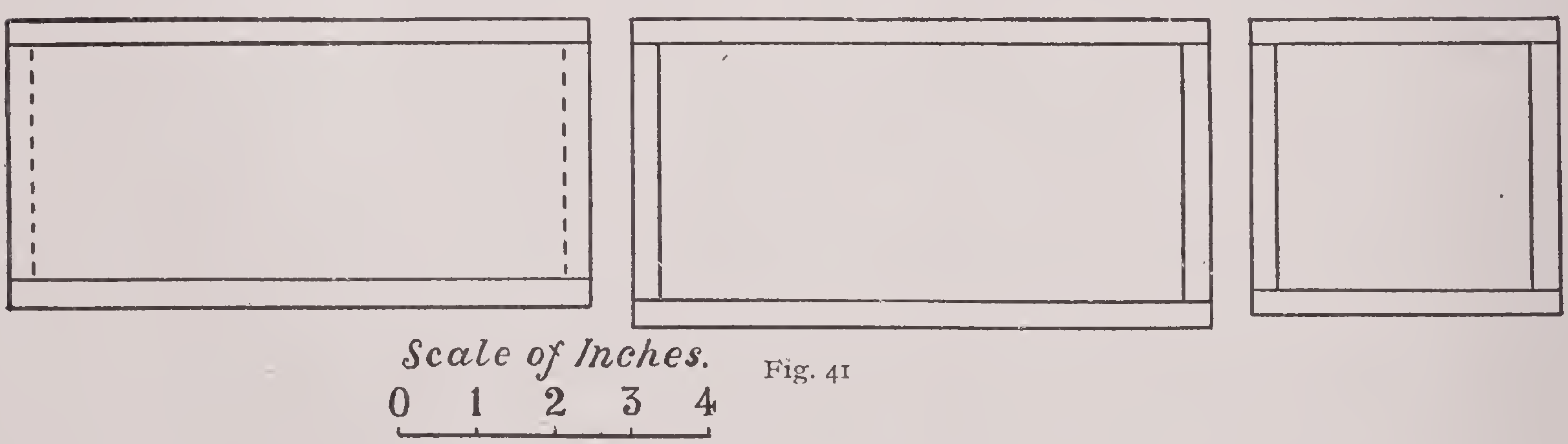



Fig. 41

draw a line and divide it with the compasses into quarter-inch sections, as in Figure 41. In this case, the distance from 0 to 4 represents a length of 4 inches. Of course, a smaller division may be adopted, as one-eighth, so that one-eighth of an inch on the drawing will represent an inch on the object to be made, but the scale must be large enough so that the workman can measure the lines of the drawing without difficulty. Figure 42 shows a working drawing of the box you wish to make, and you will see that the lines are accurately drawn to the scale indicated and require no numbers.

In making working drawings, it is often necessary to supply separate drawings of certain details and sections, which cannot be clearly

indicated on such drawings as you will make for your box. In the chapters on mechanical drawing, in another part of this volume, you will find a full description of sectional drawings. With the drawings now in hand you can proceed to the making of a box.

## LESSON VII.—MAKING A BOX—LAYING OUT THE WORK

You are now ready to put to practical use the knowledge you have acquired as to the sawing and planing of wood and the making of drawings. You decide to make a box like that called for by the working sketch in the preceding lesson. Examine your working sketch. You find that you will need two pieces of wood, each 15 inches long and 6 inches wide, for the sides of your box, two pieces each 6½ inches x 6 inches for the ends, and two pieces each 15 inches x 8 inches for the top and bottom.

First prepare the four pieces to be used for the sides and ends of the box, all of which are 6 inches wide. Their combined length is 43 inches. Take a board ¾ inch thick and not less than 44 inches in length and select the better edge of the board. Mark this "X" with your pencil and use it as a base for your measurements. Apply your try-square to the end of the board and draw a line across it at right angles to the selected edge. With your cross-cut saw, cut to this line, so that you will have a square end. Now take your rule and mark a point 15 inches from the squared end, along the selected edge. With the try-square as a ruler, draw a line across the board 15 inches from the end. If you were to saw through the board on this line, you would have a piece for one side of your box, but it is better to lay out the work farther before cutting off any of the pieces. As you will need a second piece 15 inches long, you could make a second mark 15 inches from the first and draw another line. But you have learned that the kerf of the saw will occupy a little space, and if you do not allow for it, one of the two pieces will be shorter than it ought to be. Therefore you must take your square and draw a line just beyond the first one and parallel to it. Let the space between these two lines be equal to the width of the kerf. To make sure of doing this accurately, after you have drawn the first line, you can saw into the board for about an inch, close to, but not encroaching on, the line.

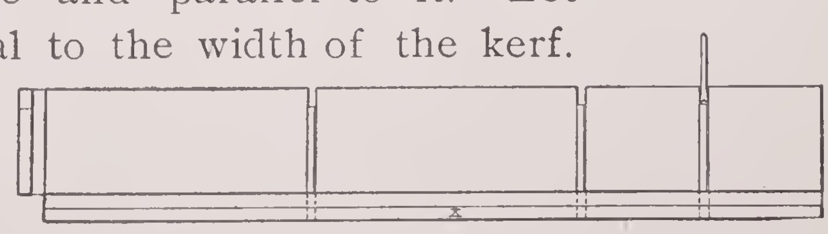



Fig. 42

Then draw your second line touching the other side of the saw-kerf. Now mark another point 15 inches from the second line and draw

another line. Repeat the sawing; then mark off a space of 6½ inches; make another saw-mark; draw another line and then mark off the fourth piece. You now have your board divided as in Figure 42.

Saw off the pieces, one after the other, taking care to make perpendicular cuts and to keep between the lines drawn as a guide for the saw. Try the edges, one after the other, with the try-square, to see if they are at right angles with the selected edge "X" of the board. If they are merely a trifle out of square, it may be possible to correct them by planing with the block-plane, as has been described; but you should aim to secure accuracy at first.

You may now dress your boards with the plane. In planing, smooth first the surface, and then the selected edge, of the several pieces. If your boards are much more than 6 inches wide, you may need to use the rip-saw to remove a piece from the side opposite the selected edge. If they are only a little wider than 6 inches you can plane them to the mark which you make with your gauge, set to 6 inches, in the manner already described.

When your boards have been sawed and planed, measure them carefully and see if they are all of exactly the same width, and if the two end-pieces and the two side-pieces are of the same length, in each case.

It may be that, in laying off the spaces on your board, you will find that the end of one of your pieces comes close to a knot. You will have to nail through the ends of your pieces, and you cannot drive a nail through a knot, nor very near to it, without splitting the board. It may be that you can so lay off your several pieces, by first marking off a side and then an end, instead of two sides, one after the other, so as to discard the section of the board in which the knot is, without wasting very much of the board. Whenever you can do so, discard knotty pieces. If it is not practicable to discard the knot altogether, let it come well within one of your pieces, and at least twice its own width from the end.

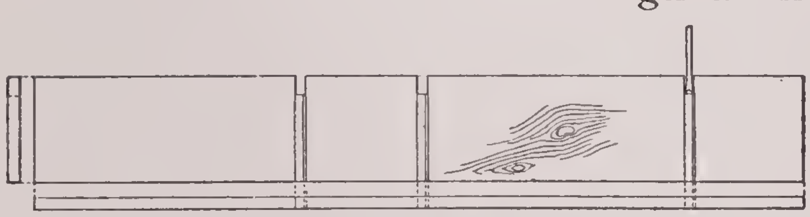


Fig. 43

Having made the side and end pieces, you may prepare in the same way the top and bottom pieces, each of which is to be 15 inches long and 8 inches wide. Refer frequently to your working sketch and use your rule and square after each sawing or planing. Remember that you are not making a box by guesswork, nor from the mental picture which you have before you, but according to the dimensions marked on the sketch.

Now comes the work of putting the box together. This introduces the use of a new tool, the hammer, and new materials, nails.

## LESSON VIII.—HAMMER AND NAILS

The saw and the plane are tools for cutting. The hammer is a tool for striking. It consists of a head, made of steel, or steel-faced iron, and a handle of wood. The head has a face, or ball, which delivers the blow; the eye is a hole in the center of the head in which the end of the handle is inserted. The end of the head, which is opposite the face, is shaped to a claw, for pulling nails, or to a peen, which is used for riveting. The eye widens toward the top and, when the end of the handle has been inserted, the latter is split, and a wedge is driven into the split, which prevents the handle from slipping out of the eye. Sometimes the wedge becomes loosened, and the head ceases to pinch the handle firmly. When this occurs, the end of the hammer farthest from the head should be struck sharply on some solid object, which will cause the head to settle firmly down upon the handle, and the wedge in the head end may then be driven in farther. This will prevent the head from slipping.

Probably you think that "everyone knows how to use a hammer"; but there is an incorrect, as well as a correct, way of using it, and you wish to avoid the former. Three movements are employed in using hammers of different weight. The light tack-hammer is for tapping, that is, delivering light blows, and is operated by a wrist movement. Thin nails and brads, which are driven with a heavier hammer, but are liable to bend if struck too hard, are struck with a movement which comes from the elbow, only the forearm furnishing the power. Large nails are driven with a blow from the shoulder.

For the present you will use only the claw-hammer, which is heavy enough for striking blows from the shoulder when desired. Take a block of soft wood about six by eight inches, and with ruler and compasses mark on its surface twelve points equally distant from one another. Place the block on the bench, and stand behind it, with the right hand grasping the handle of the hammer so that about an inch projects beyond the hand. This position is shown in Figure 44. When you grasp the hammer in this way, you are enabled to deliver much heavier blows than when the handle is grasped at a point nearer the head.

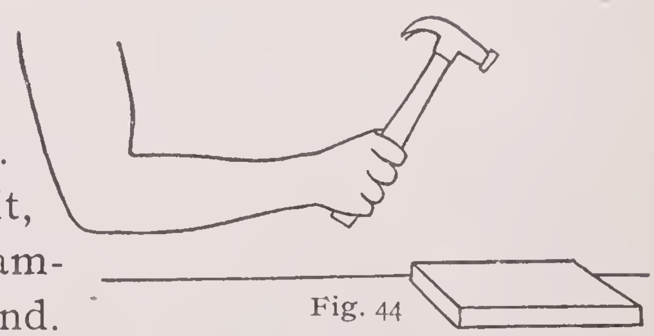
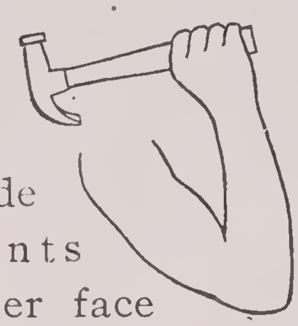


Fig. 44

Rest the face of the hammer on one of the points you have marked on the block of wood, then raise it with a motion from the elbow, and try to strike the point on the block so that the face of the hammer will make a round dent of which the point will be the center. Strike squarely. Your hammer should sink as deeply in the wood at the side farthest from you as it does on the near side. Re-

peat the blow and try to have the hammer strike within the circle made by the first blow.

When you have practised the elbow-stroke on half the points marked on the block, raise the arm from the shoulder and strike a heavier blow. This position is shown in Figure 46.



When you have made dents at all the points marked, turn the other face of the block upward and without marking it, try to make on it the same number of dents as before, at equal distances apart. This exercise will teach you how to strike square blows with precision, that is, how to deliver successive blows in the same place. You will realize the importance of learning to do this if you have seen people, who seldom use a hammer, trying to drive a nail. Some strokes miss the nail altogether and at other times glancing blows are struck which bend but do not drive the nail.

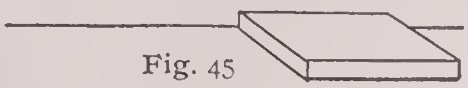


Fig. 45

Fig. 46

Nails are made in a great variety of forms, some of iron and some of steel. Iron nails have rectangular heads, which project beyond the shank so as to form a cap. The shank tapers from the head toward the bottom, which is cut off squarely, and does not end in a sharp point. Two of the sides are parallel and the other two sides are inclined so as to form a wedge. You should remember this when you drive iron nails, because the inclined sides make the nail a wedge and if it is driven in so that the wedge pushes the fibers of the wood apart, it may split the board, as in *a*, Figure 47. But if you drive the nail so that the wedge acts in the direction in which the fibers run, that is, with the grain of the wood, there is less danger of splitting.

Fig. 47

Iron nails are used chiefly in coarse work; for fine work, steel wire nails are generally employed.

Take a block of wood and mark off a series of points as you did before. Six points, in line with each other, will be sufficient. Take a nail between the thumb and forefinger of the left hand and place the entering-end at one of the points on your block. Hold the nail upright and with an elbow-movement give it a few preliminary taps to start it into the wood. Increase the weight of the blows, and when the nail is settled well in place, release the hold of the left hand and with strong

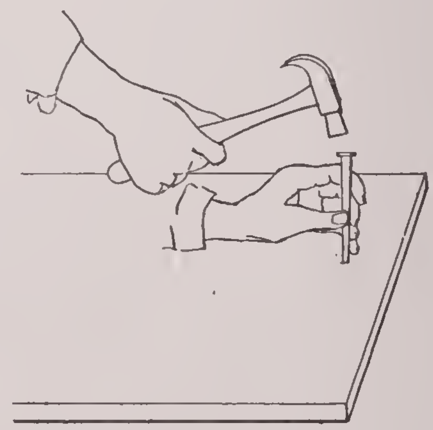


Fig. 48

shoulder-blows drive the nail home. It should sink into the wood until the head is flush with the surface of the board, but do not try to drive it farther with the head of the hammer or the latter will mar the wood around the nail. Good work should show no hammer-marks. But it is desirable to sink the head of the nail a little below the surface of the wood. To accomplish this, use your nail-set, which is a piece of hardened steel, with one end tapering to a circle. Place the tapering end squarely on the nail-head and strike the head of the nail-set one or two blows with the hammer. This will drive the nail farther into the wood and yet the wood surrounding the nail will not be marred.

Fig. 49

Drive another nail into the block, but not so far that the head will enter the wood. Let the head remain a quarter of an inch above the surface. Now you can withdraw the nail. Grasp the hammer as shown in Figure 50, and slide the claw against the nail, so that the edges of the claw will obtain a good grip on the head. If you now pull the handle toward you, the nail will be pulled upward, but after it has been drawn up half an inch, it will bend, if the head of the hammer rests on the wood, and the force exerted in pulling the nail will cause the head to sink into the wood, which will leave an unsightly mark. To avoid both bending the nail and marring the wood you must place a piece of wood under the head of the hammer. We will suppose this piece is an inch thick and two inches wide. The length is not a matter of importance. Any scrap of waste wood will serve. Rest the head of the hammer on the wide side of the block and then pull on the nail. It will be withdrawn for perhaps three-quarters of an inch, but, if pulled farther, will bend. Now turn the block on which your hammer rests so that the narrow side is uppermost. This will give the head of the hammer a higher point on which to rest. Again draw the nail and it will come farther upward. If it does not wholly leave the wood before it again reaches the point where continued pulling will bend it, you must find a wider piece of wood on which to rest your hammer. In this way the nail may be withdrawn without bending it, without widening the nail-hole, and without marring the surface of the wood.

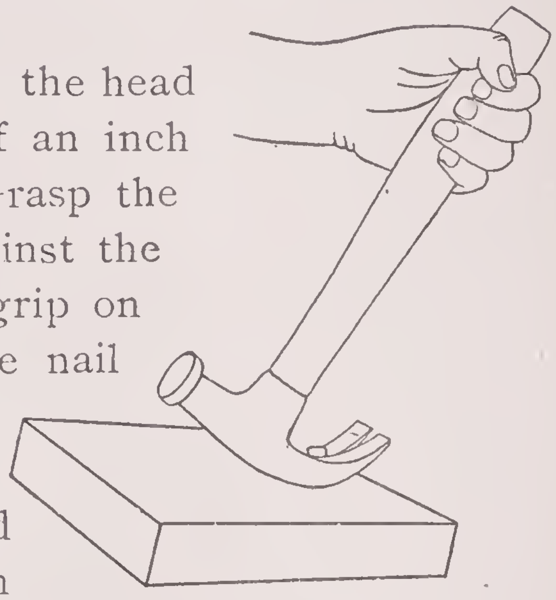


Fig. 50

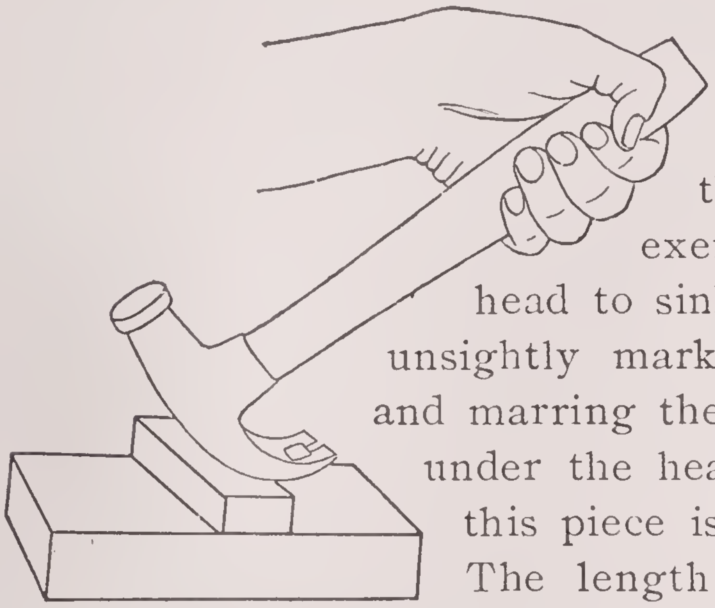


Fig. 51

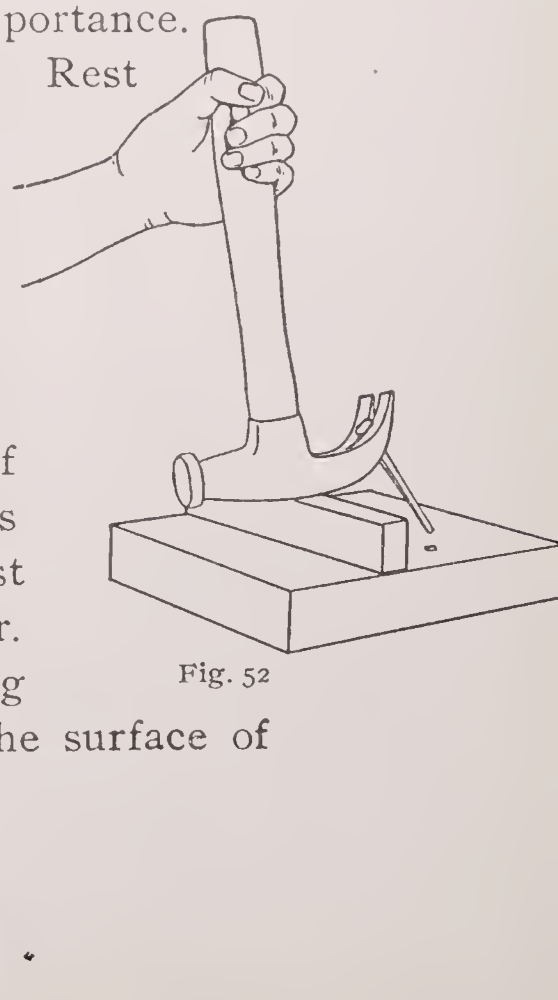


Fig. 52

Repeat this exercise in driving and withdrawing nails, several times. In driving, it is probable that in one or more cases you will release the nail from the left thumb and finger before it has fairly entered the wood and the next blow of the hammer, unless it strikes the head squarely, will cause the nail to bend a little to one side. Do not continue to drive it while it is in this position, but move the nail to an upright position, with the fingers, if you can do so without bending it, and then drive as before. Sometimes, when a nail has been driven part way into the wood, it encounters a place where the fibers of the wood are harder, or, it may be, a knot, and when the hammer strikes again, the nail will bend. If it has gone too far to be straightened with the fingers, it may be tapped with the hammer on the side that leans toward the wood, and so bent back to an upright position. If it bends again, when driven forward with lighter and more careful blows, it is best to withdraw the nail and, after straightening it, enter it at another point.

A bent nail should not be carelessly thrown away. It is a simple matter to straighten it, and it is important that you should learn not to waste your materials, whether wood, nails, screws, or glue. Rest the head and point of the nail on a piece of waste wood, and hold it firmly with the fingers of the left hand while you tap it with the hammer at the point where it is bent. When it is nearly straight, move the head beyond the edge of the block, and continue tapping it, while rolling the nail, until the shank of the nail touches the wood throughout its length. This will make it again available for use.

## LESSON IX.—NAILING THE BOX TOGETHER

You are now ready to nail the pieces of your box together. Remember that the sides are to be nailed to the ends, not the ends to the sides. When the edge of a side-piece is flush with the surface of the end-piece, as in the completed box, the end-piece will cover a space three-quarters of an inch wide at the end of the side-piece. As you wish to drive nails through the side-piece into the center of the edge of the end-piece, you should draw a light pencil mark across each end of the side-pieces, three-eighths of an inch from the edge and parallel to it. On each of these lines mark four points, two at a distance of one inch from each end and the other two at equal distances between. Lay one of the side-pieces on the bench and drive eight nails nearly through the wood at the points you have marked.

Now fix one of the end-pieces upright in the vise, and place the end of the side-piece against it. With your finger try the edges, to make sure that the end of the side-piece is flush with the surface of the end-piece. If you are using iron nails, be sure that you hold them so that the parallel sides of the nail will be parallel to the grain of the wood. Drive one of the nails nearest the center of the side-piece into the end, but do not drive the head quite down to the wood. The concussion produced by driving this nail may cause the board to move from its proper position. Readjust it if necessary, so that it be flush with the surface of the end-piece again, and drive one of the corner nails nearly home, holding the side-piece in position with the left hand. Now try the end with your square and, if the side-piece is not exactly flush with the end, place a block against the edge and drive it forward or back a little, as may be needed. Drive the other two nails almost down to the wood, and if the edge is now square with the end, drive all the nails flush with the surface, taking care not to mar the wood with your hammer.

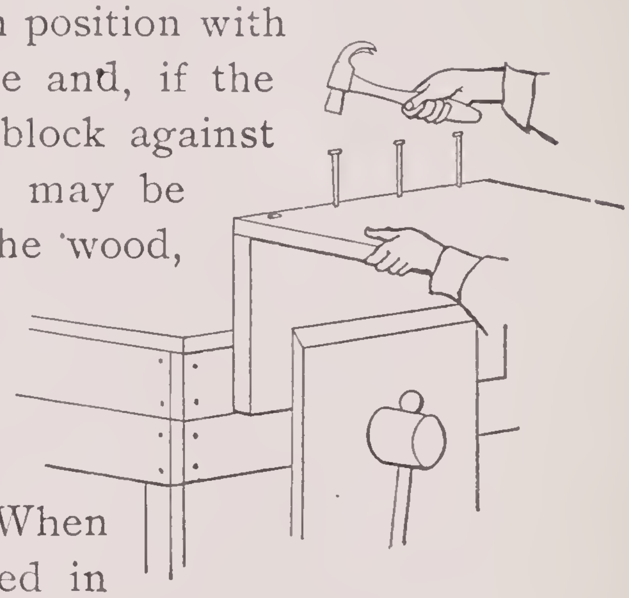


Fig. 53

Fix the other end-piece in the vise and nail the other end of the side-piece to it in the same way. When nailing to an end, be careful to have the board fixed in the vise so that it will not be driven down, and thus leave a narrow space between itself and the side-piece.

When you have nailed one side-piece to both end-pieces, lay that side flat on the bench, and, after starting four nails in each end of the other side-piece, place it on the end-pieces and nail it to them in the same way as before. In doing this you will need to be very careful to get the second side-piece square with both end-pieces. If it is not, your box will be in « winding » when you have finished nailing. When you set the box on its edge, on the bench, it should touch the bench at all four corners, if the surface of the bench is plane.

« Winding-sticks » are used in testing for winding. These are two strips of wood, for example, $\frac{3}{4}'' \times 2'' \times 30''$, which have straight and parallel edges. They must be finished with exactness. If these strips are laid across the box at opposite ends, and you sight across them, you will be able to detect any winding which exists in the box, even though it is so slight as not to be noticeable when you look directly at the box. The reason for this is that the long sticks carry the sides of the angle of divergence far enough from the apex to enable you to detect the divergence, which may be very slight in the box. This will show whether the box is in winding.

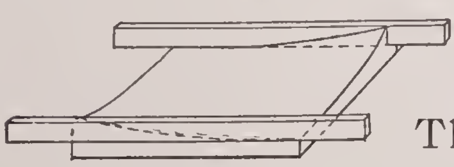


Fig. 54

The same test may be used to determine whether a board is free from winding. If the box proves to be in winding, it should be possible to correct the trouble with the plane, by taking thin shavings from the edges, at the proper places, until the box will touch a plane surface, at all four corners.

With your box resting on edge, on the bench, you may now nail the bottom in place. When you have done this, your box is ready for the cover. Ordinarily, you would not nail the cover on unless the box were to be first filled with articles which were to be stored or sent away, but as you are now learning how to use your tools rather than to make a box, you may turn the box over and nail the cover on. Before nailing the bottom and the top to the sides, you will draw a line three-eighths of an inch from the edge, all the way around the board, and mark on it the points where the nails are to be driven, as you have done in nailing the side-pieces to the ends.

Now try your box on all sides with the square. See if the ends are at right angles to the top and bottom, and to the sides. See if the top and bottom are at right angles to the sides and ends. With your rule, measure the box carefully and see if you have made it of the dimensions indicated on your working sketch. Remember that you are striving to do accurate, not passable, work, and that, even if your box is neat in appearance, it is not up to the standard you have set unless it conforms to the given dimensions.

## LESSON X.—TAKING THE BOX APART

You have many times seen the wooden cover removed from a box with so little care that the wood is split and disfigured, and if the box is to be used again, a new top must be provided for it. This causes a waste of wood and of labor. Before you can apply your box to any ordinary use you must remove the cover, and in order to learn how to take apart nailed work, you may not only remove the cover but separate all the pieces from one another. This should be done carefully, so as to leave no marks on the wood.

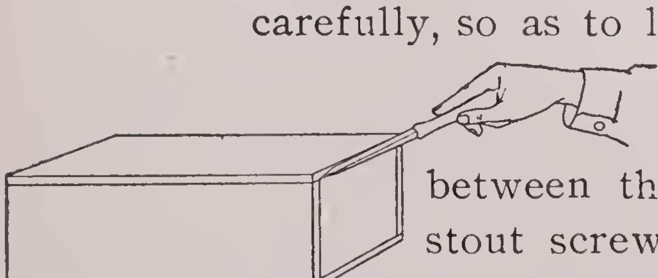


Fig. 55

The top should first be removed. To do this, you will have to insert a thin steel or iron wedge between the cover and the end at the corner of the box. A stout screw-driver with a flat blade may be used for this purpose. Press it inward, across the end-piece, until the end of the screw-driver has reached the inner edge of the end-piece. A cold chisel may be used for this work, but it will mar the wood more than the flat-bladed screw-driver. Now raise the handle of the

screw-driver, not with a jerk, but slowly. When you have raised the top so that the corner nail has been drawn upward a little, move your screw-driver along a little farther and lift again, near the next nail. Do this until all the nails at the end have been raised a little. Now place the screw-driver near the nails that were driven into the side-pieces, one after the other. In this way you may raise the top a little, on all sides of the box.

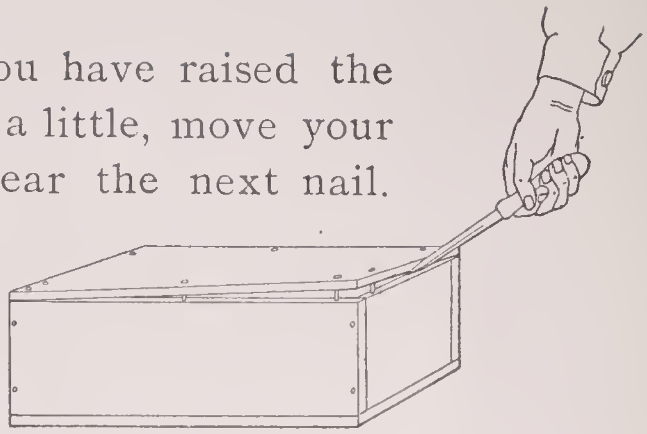


Fig. 56

Do not try to pull the top off by drawing the nails at one end entirely out before the nails in the other end have been loosened, or you will bend the nails and possibly split the wood at the farther end. When the top has been raised half an inch, you can turn the box on one side and, applying a block to the edge of the top, drive the latter farther from the sides with blows of the hammer, delivered on the block. Repeat this, moving the block along and pushing the top off a little at a time, until the nails are released from the sides and ends and the top comes clear of the wood. The nails still remain in the top. Place the board, face down, on the bench, with the end projecting an inch beyond it, and drive the nails out by striking them on the points. When the points are flush with the inner side of the board, turn it over and pull them out with the fingers, if you can. If they will not yield to a pull from the fingers, use the claw of your hammer to remove them, resting the head of the hammer on a block. Straighten the nails and lay them aside.

To remove the bottom, rest the box on its side, and, with a block to receive the blows of the hammer, drive the bottom away from the sides and ends. This can be much more easily and quickly done with the hammer than by using the screw-driver, as you did to start the top. Having removed the bottom, you can take apart the skeleton of the box in the same way, separating each side first from one end and then from the other. For convenience, you can fix the ends in the vise while you are doing this. The block on which you strike should be placed close to the inner surface of the end of the box, so that the blows will be delivered as near the nails as possible, and, if there is not room to strike with the face of the hammer, strike with the broad side of the head. As you separate the pieces, mark them so that they can be quickly fitted together again in the same position, and lay them aside. Straighten all the nails you have withdrawn and reserve them for future use.

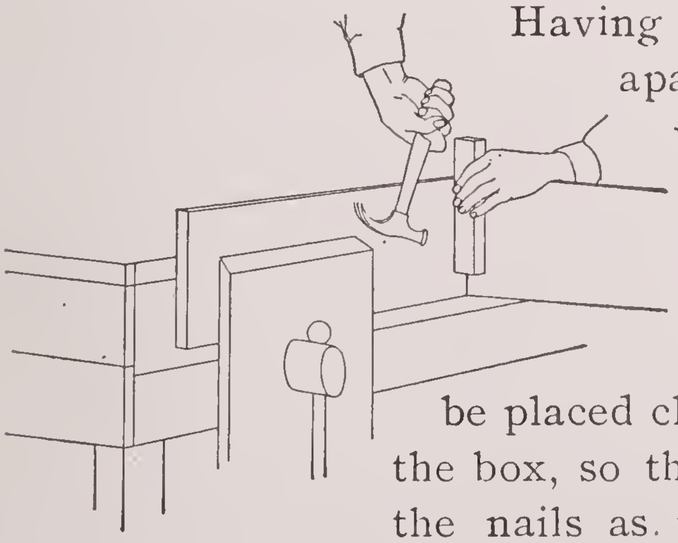


Fig. 57

## LESSON XI.—THE BACK-SAW

Before we put the pieces of the box together again, we will take up the use of certain tools which you have not yet handled. One of these is the back-saw. See figure 58. It is a crosscut-saw whose blade is of the same width and thickness throughout. In the ordinary crosscut-saw, which you have already used, the blade tapers from the handle toward the opposite end, both in outline and in thickness. See figure 16. The blade is also thicker at the toothed edge than at the back of the saw. The back-saw has a thin blade, of even width and thickness, and, to prevent it from bending when it is thrust through the wood, a stiff back is added. This gives the blade the necessary strength to prevent "buckling," but it also limits the depth of the cut, which can be made to a distance equal to the width of the blade. The teeth of the back-saw are much finer than those of the ordinary crosscut-saw and have less "set," so that they make a much narrower kerf. This saw is used to saw either with or against the grain, where fine work is essential. A small back-saw, with still finer teeth, which have no "set," is called a "dove-tail saw," and in another lesson we shall see what use is made of it.

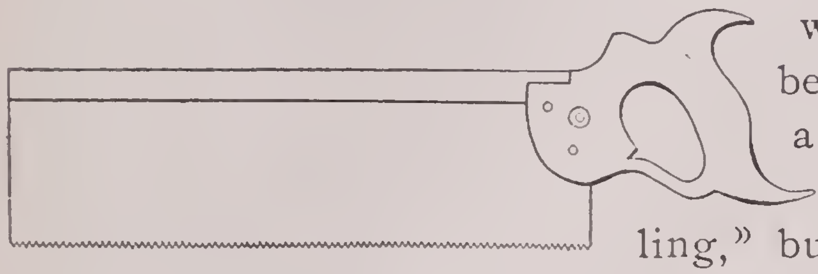


Fig. 58

As the back-saw makes a fine cut, it is used in making mitered corners. For this purpose it is used in connection with a miter-box. A miter-box may be made of three pieces of seasoned board, two pieces being nailed to the third, as in figure 59. It is a box without top or ends. At the center a saw cut is made through both sides, at right angles to the sides, as at A. The sides are just high enough to stop the back of the back-saw when the toothed edge has reached the bottom of the miter-box. Saw-kerfs B, are then made diagonally across the box, to the right and the left of the center, at an angle of 45° to the sides of the box. When a piece of wood is to be cut off at right angles to its edge, it is inserted in the miter-box and the line marked for cutting is placed opposite the kerf A. The piece to be sawed is grasped by the left hand, while the back-saw, sliding back and forth through the kerf, descends upon the stick and cuts it off squarely. If the wood is to be mitered, as, for example, in making a picture-frame, the molding is first sawed at an angle through one diagonal; the saw is then shifted to the other diagonal and the other end is sawed at an equal opposite angle. When four pieces of

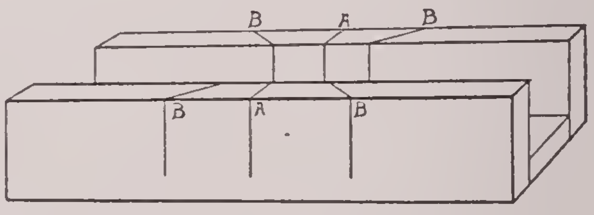



Fig. 59

equal length are sawed in this way, if the ends are joined, each corner will form a right angle and the edges will form a square. You will have no difficulty in making such a miter-box for yourself, and you will find it very useful.

Our present use for the back-saw involves the use at the same time of a much simpler tool than the miter-box, that is, the bench-hook, which you see represented in figure 61. This is made of well-seasoned stock so that it will not be likely to warp. To a board eight inches wide and twelve inches long, are fastened two strips of wood, one inch thick, three inches wide, and eight inches long. One of these strips is fastened to the upper side of the board at one end, and the other strip to the under side of the board, at the other end. A bench-hook cut from a single piece of wood is illustrated in Figure 60. It is made with care, so that the edges of the cross-strips shall be perpendicular to the sides of the board

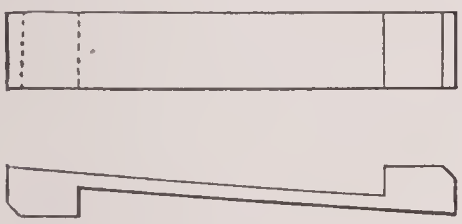


Fig. 60

In use, the bench-hook is placed on the bench, the cross-strip on the under side being pressed against the side of the bench. The board to be crosscut is then placed on the hook, and pressed against the edge of the cross-strip on the upper side. By pushing the board against the cross-strip, with the line where it is to be cut off opposite the end of the strip, you can keep it firmly in place while using the back-saw, and the board can be cut through without allowing the saw to strike the bench and mar it. The end of the crosspiece serves as a guide for the saw in making the cut. In starting the saw, raise the handle and make the first few strokes carefully, with the saw pointing downward, as shown in the illustration. As soon as the kerf is well started, hold the saw with the edge nearly parallel to the surface of your board and saw slowly, letting the teeth touch the board all the way across. Keep the saw upright and in touch with the crosspiece, but not pressing hard against it, and you will be able to make a clean crosscut.

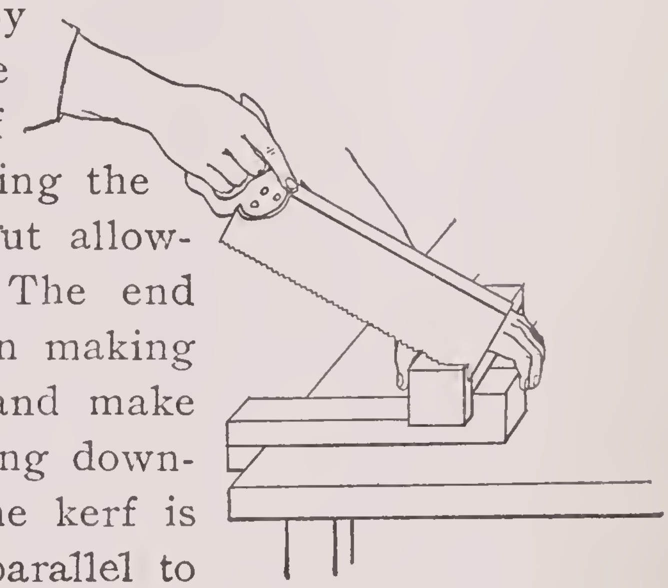


Fig. 61

To apply this use of the back-saw practically, you may take the pieces of your box which you laid aside. If the box were to be nailed together again, with the nails replaced in the holes from which they were withdrawn, the box would not be nearly so strong as at first. You could drive the nails in new places, and this would make the box as strong as before, but would leave a row of unsightly nail-holes around the edge. As we wish the box to look neat, when completed, we will shorten it a little by cutting off enough

wood at each end of the sides, top, and bottom to do away with the nail-holes.

Before driving the nails in your box, you made a light line, with the lead pencil, across the ends of the sides, top and bottom, three-quarters of an inch from the end, in each case. You may now try these lines with the square, and after making sure that they are at right angles to the "working edge," which you must keep in mind, darken the lines with the lead pencil. On these lines, saw off the ends of the boards, using the back-saw and the bench-hook as already described. If you now assemble the parts of your box in proper position, you will have no nail-holes at the ends, but the top and bottom pieces will show the nail-holes along the sides. To reduce these two pieces to the proper width will afford you an excellent opportunity for practice in the careful use of the rip-saw and planing to a line. When the top and bottom have been reduced on the long edges to the three-quarter-inch line, as in the case of the ends, it appears that the end-pieces are too long by an inch and a half. No lines were drawn on the surface of the end-pieces, but you may now draw the three-quarter-inch line at each end, and saw as before.

Again reassemble the pieces of your box, and you will see that they are prepared for nailing together again. But, instead of nailing them, we will again lay the pieces aside and learn something of the use of the chisel. Before we are done with the chisel, we shall learn of a better way of putting the box together than by simple nailing.

## LESSON XII.—THE CHISEL: PARING

The chisel is a tool which does the work of a knife, or a plane, especially in places where neither of those tools can be used, by reason of its size or shape. The blades of chisels are from five to ten inches long, and in width they vary from one-eighth of an inch to two inches. The blade is made of steel, with a narrow shank which is fixed in a wooden handle. The blade is thin near the cutting end, but it increases in thickness toward the handle; and very narrow chisels are made especially thick, in order to give them strength. Figure 62 represents a chisel with the outlines of the cutting end exaggerated in order to give a clear idea of the form produced by grinding. The back of the chisel is flat. On the face, the cutting end is beveled from E to F; this bevel is produced on the grindstone; from F to G is a second and shorter bevel, which is produced


Fig. 62

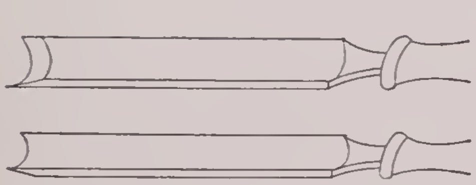


Fig. 63

on the oilstone. This second bevel is so narrow that it is not perceptible unless you examine the chisel closely. The first bevel is formed at an angle of 25 degrees; the shorter bevel, or cutting angle, measures about 35 degrees. You will see that the cutting edge of the chisel resembles that of the plane-iron. Chisels which have curved blades are called gouges. The cutting edge is usually on the convex side; in some gouges, however, it is on the concave side.

The draw-knife is another form of chisel. This has a long blade with the ends bent at right angles to its length. These ends are inserted in wooden handles and the cutting edge is ground on the inner side of the blade, or that nearest the handles. See Figure 64. Other chisels are pushed against the wood and away from the operator; with the draw-knife the action is reversed, and the operator draws the blade toward him.

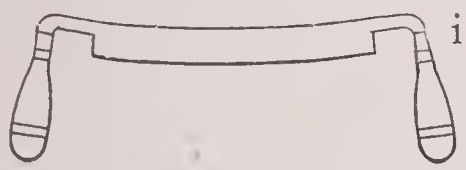


Fig. 64

The spokeshave is a smaller tool, with a short blade, held in a frame as a plane-iron is held. It is drawn toward the operator, who uses both hands in working it. It is used for finishing surfaces where a very thin and narrow shaving is to be taken off at each stroke, as in finishing the spokes of wheels; hence the name spokeshave.

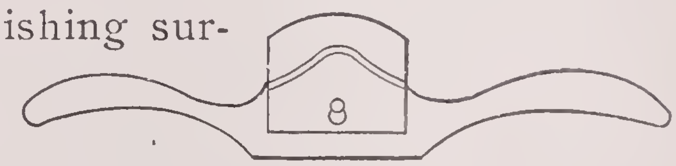



Fig. 65

The draw-knife and the spokeshave are used for much the same purposes as the jack-plane and the smoothing-plane, respectively.

For the present, we will use only the straight, or « firmer » chisel, as it is called. In using a chisel, always remember that it must be handled with great care, for it is, or should be, one of the sharpest tools used by the wood-worker, and its edge is unprotected. You are not likely to be cut by the plane-iron, which is guarded by the stock of the plane, nor by the saw, since it is not easily turned against yourself; but the chisel is pushed with great force against wood on which it may be necessary to rest your fingers and, in any event, it has so keen an edge that, to turn it carelessly against the hand, may produce a serious, even a dangerous, cut. When you are obliged to carry a chisel from one place to another, always hold it with the cutting edge farthest from you, and keep constantly in mind the fact that you are carrying an edged tool. Do not carry it with the edge downward, for if it should drop from your hand it might easily pierce your shoe and maim your foot. When not in use, a chisel should always be placed in a rack at the back of your bench, or in the toolbox, with the edge pointing downward. The tool should be supported at the shoulder of the handle, so that the edge does not rest on any hard substance.

For the first exercise with the chisel, we will undertake to reduce a rough edge to a smooth one, by paring. Take a piece of 1½-inch plank, 8 inches or 9 inches long, which has a "wavy" grain. Split the piece in two, with the hatchet. The edges produced by splitting will be irregular in outline, as in Figure 66. Take the wider of the two pieces and mark a line around it parallel to the straight edge and just within the irregular edge. Fix the piece of wood in the vise, with the irregular edge upward. Grasp the chisel in the right hand, with the end of the handle resting in the hollow of the palm. Lay the chisel flat on the wood, with the cutting bevel upward, and hold the blade down by pressing on it with the fingers of the left hand. Push the chisel forward, keeping it flat on the wood, and it will act very much like the plane. When the grain of the wood is comparatively straight, the chisel may be pushed along in this way and it will, without much difficulty, reduce the edge to a straight line.

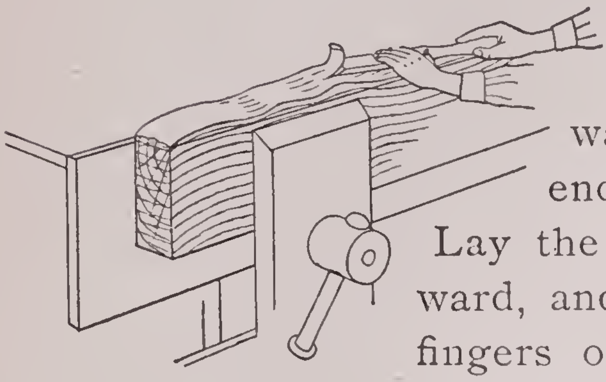


Fig. 66

But where the grain is irregular, so that in pushing the tool forward you work now with the grain and now against it, it is better to push the chisel across the wood in an oblique direction and with a sliding motion. There is a good reason for using the sliding motion. As you have already learned, every cutting edge, however keen, reveals a succession of fine nicks, or teeth, when seen under the microscope. If the edge is pushed straight forward, the effect is the same as in pressing the knife straight down on the wood, as in Lesson I, but if the tool is given a sliding motion, the microscopic teeth cut into the fibers of the wood just as the saw does. The proper way to use the chisel, therefore, is to slide it to the right or to the left at the same time that you push it forward. In Figure 67 you will see this method illustrated. Holding the chisel at an angle to the side of the piece of wood, push it toward A, but at the same time slide it to the right, toward B. The combination of the two motions brings the chisel to the point C. This is perhaps the most important thing to be remembered in connection with the use of the chisel, and you should practise this motion until you can control the tool as you wish. If the edge of your piece of wood presents a very irregular surface, you will find it well to "score" the edge before paring it. To do this, you should hold the chisel at an angle of 60 degrees or more, so that the edge is not pushed along, but down into the wood. This turns up thick chips. Then, scoring from the opposite direction, the higher points

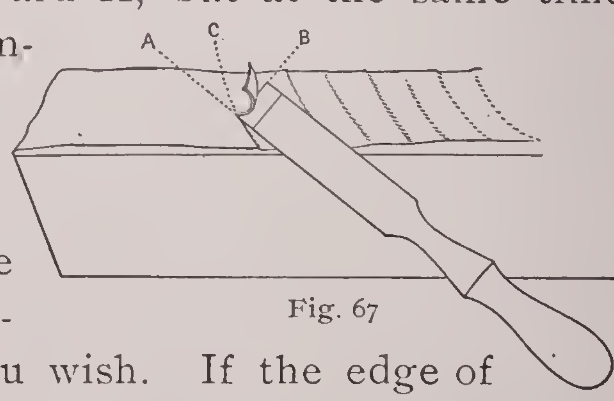



Fig. 67

of the edge are cut away and you have the edge prepared for paring.

You will sometimes have occasion to pare the edge of a piece of wood that has a curved outline. Take a piece of pine, one inch thick, and with the dividers draw a semicircle at the end. Place the stick on a waste board which lies flat on the bench, and hold the chisel in the left hand, with a firm grip. The blade should be perpendicular to the surface of the wood. To drive the chisel downward through the wood, you will hold the stick with the left hand and press hard on the end of the handle with the right hand. If the wood is very tough, it may be necessary to hold the chisel in the left hand and strike the end of the handle with the right hand, and it may be advisable to hold the stick to the bench by means of a handscrew. Make the first cut nearest the side of the stick, with the edge of the chisel cutting across the grain. This will cut off the wood at the point where you begin and split it to the top of the stick. Take off successive chips in this way, until you reach the center of the stick. Then begin and repeat the work on that side of the stick. Still holding the chisel upright, you can now pare off the irregularities and leave a perfectly rounded end. If the chisel is not held perpendicular to the surface of the stick, the edge will be beveled. It is necessary to have a keen edge on the chisel in order to do this work neatly. Do not cut down on to the bench, as that would mar it, but keep your stick on the piece of waste wood, where the chisel marks will do no harm. (See Fig. 68.)

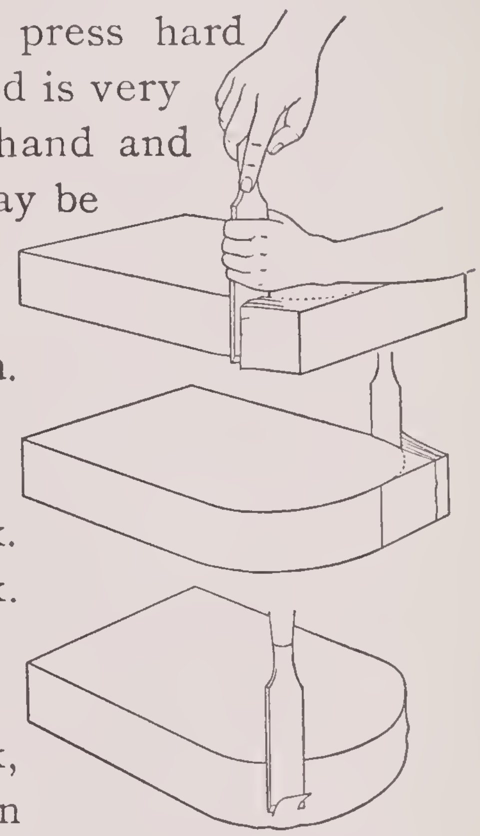


Fig. 68

## LESSON XIII.—THE CHISEL: CHAMFERING

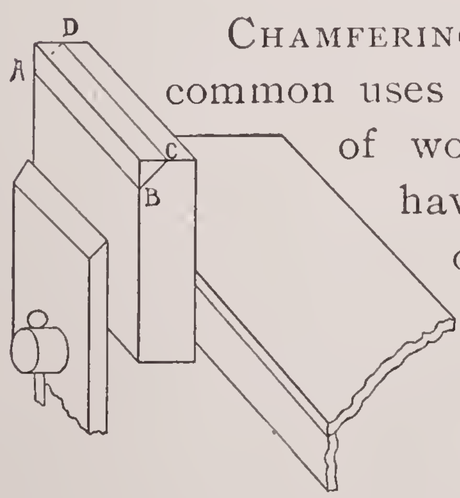



Fig. 69

CHAMFERING is another name for beveling. One of the common uses of the chisel is to chamfer the edges of pieces of wood. Suppose you take the stick on which you have just made a rounded end and chamfer the other end. Draw a line across the surface of the stick, half an inch from the end. This line appears as AB in Figure 69. From B draw the line BC to a point in the center of the side. Draw CD to the other side of the stick and the line AD on the farther side. In the illustration, the farther side of the stick is hidden from view and AD is therefore represented by a dotted line. These lines, AB, CD, should be drawn with the marking-gauge, and BC, AD con-

nected by lines drawn with lead pencil and ruler. As the stick is an inch thick, CD will be midway between and parallel to the top and bottom surfaces.

Fix the chisel firmly in the vise so that the line CD will be above the jaws of the vise. This will leave both hands free to guide the chisel and, as the work must be carefully done, you will need them.

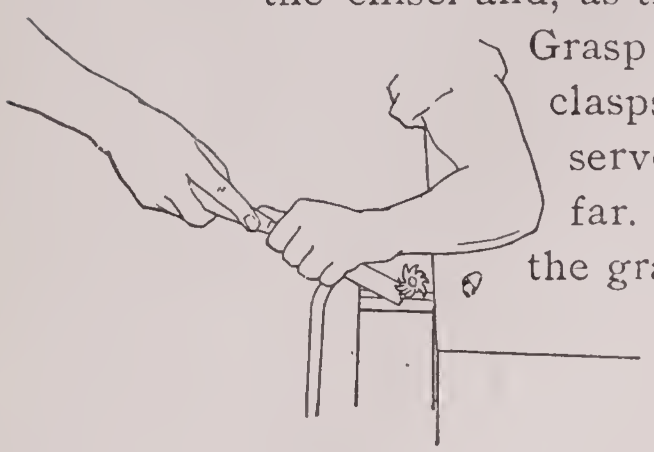


Fig. 70

Grasp the chisel as shown in Figure 70. The left hand clasps the blade, while the wrist rests on the wood, to serve as a check and prevent the chisel from going too far. Now push and slide your chisel obliquely against the grain of the wood, taking off a thin shaving from X to Y. Start the next cut a little farther toward B, and take off another thin shaving. See that your shaving is of the same thickness throughout, so that you will not take off more from one side than from the other. Continue chamfering until the chisel, lying flat on the beveled wood, will touch all the lines AB, BC, CD, DA (Fig. 69) at the same time.

Remove the stick from the vise and mark on the side not beveled lines to correspond with AB, BC, and DA. The line CD is, of course, at the edge of the stick where the bevel meets the orignal square surface. You may now chamfer the stick as marked, but instead of putting it in the vise, hold it in the left hand, with the side to be chamfered turned from you, and the narrow side upward. Rest the end on the waste block and, leaning over, push your chisel downward, not forgetting to slide it. You are now guiding the chisel with the right hand only, and must be careful to keep it upright. To obtain greater pressure, you may hold the chisel with the flat side close to your body and press down from the shoulder, as shown in Figure 71. In this way you can push the chisel with greater force than with the arm extended full length. When you have chamfered to the lines drawn, the bevel thus produced should be an exact counterpart of the one previously made, and the line CD should be represented by a thin, straight edge.

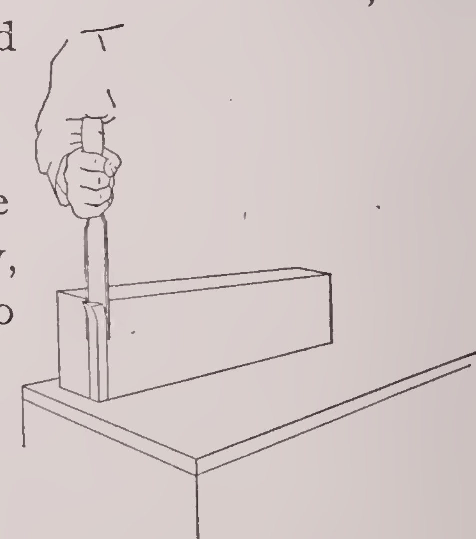


Fig. 71

For another exercise in chamfering, we will chamfer the face of a block so as to make twelve square pyramids. Take a board one inch thick and saw out a piece 3 inches x 4 inches. It must be strictly rectangular. With the dividers point off 1-inch spaces on all four sides. Apply the ruler and draw straight lines across the block. Draw a line XY around the edge of the block, $\frac{1}{2}$ inch from the sur-

face edge, and continue the lines on the surface to meet this line at right angles, as in Figure 72. With the back-saw, make clean, narrow kerfs through the lines AB, CD, EF. Be careful not to cut below the line XY, on either side. Repeat the saw-cuts across the block from the side which will now appear as in Figure 73. Now draw the lines MNO, OPQ, and QRS. Hold the block in the vise and begin to chamfer on the edge VA. Chamfer to the line MN, and then to the line NO, cutting across the grain of the wood. Repeat this, going all the way across the block, until it presents the appearance shown in Figure 74. With the dividers, mark the center of the

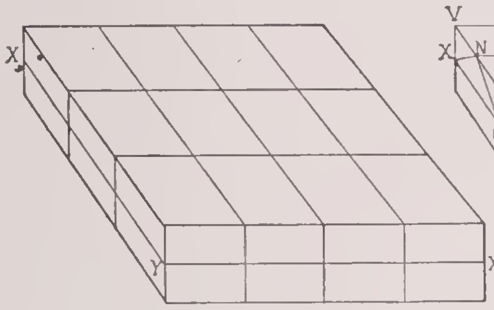


Fig. 72

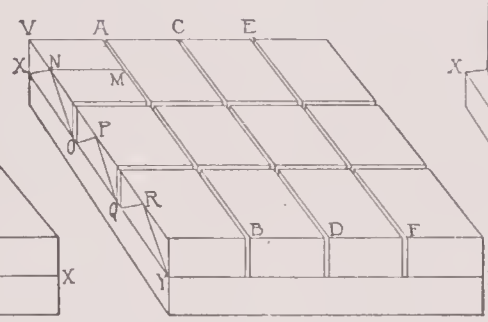


Fig. 73

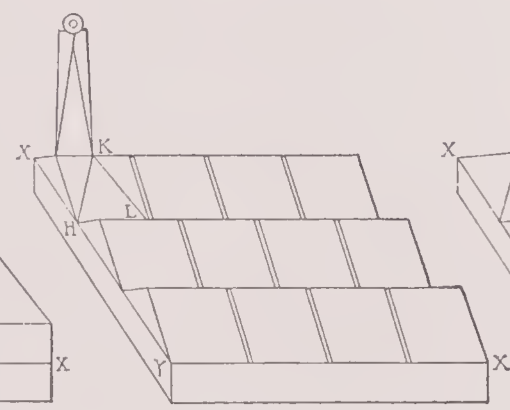


Fig. 74

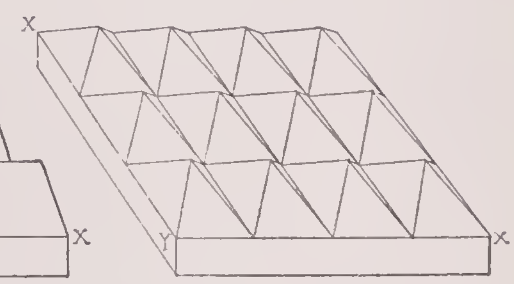


Fig. 75

apex of each pyramid, and from these centers draw diagonals to all four corners in each case. Two of these diagonals are shown in the figure. The corresponding diagonals on the other side are hidden from view. With the chisel, now cut V-shaped grooves to the diagonals. Remember that you are now cutting with the grain of the wood, and be careful to take off very thin shavings, so that the chisel may not plunge in too deep and tear off large splinters. When you have completed this part of the exercise, the block will look as in Figure 75, presenting twelve square pyramids. As you cut near the apex of the pyramid, in each case, cut slowly and carefully, or you will chip off the top of the pyramid, which should come to a point, and the apex so formed should be on a level with the apexes of all the other pyramids in the block.

## LESSON XIV.—THE CHISEL: MORTISING

In practical woodwork the chisel serves many important uses, one of which is in the cutting of mortises. You should learn how to do this work well. A mortise is a hollow cut intended to receive a projection, called a tenon, which fits snugly into the mortise so that the two pieces of wood are joined more or less firmly together.

To make an open mortise-and-tenon joint, take a piece of 2-inch x 3-inch lumber, 12 inches long, and plane it smooth. Cut it in two, so

that you will have two pieces, each 6 inches long, and of the same breadth and thickness. Mark one piece A and the other B, and mark one of the narrow sides of each with an X, to show that those surfaces will be adjacent when the joint is completed. The mortise is to be $\frac{3}{4}$ inch wide and 3 inches deep, since that is the width of B, the piece to be fitted into A. On the narrow side of A mark out with gauge and square the space to be mortised. Continue the parallel lines at right angles, across the end of the stick, as in Figure 76, and repeat, on the farther side of the stick, the marks first made. Take the piece B, and on the narrow side mark the lines which show that the tenon, or projection, must be $\frac{3}{4}$ inch wide and 3 inches deep, when completed. Carry these lines across the end and repeat the first marks on the farther side. C in the illustration shows the parts of the wood that are to be cut away, in each case.

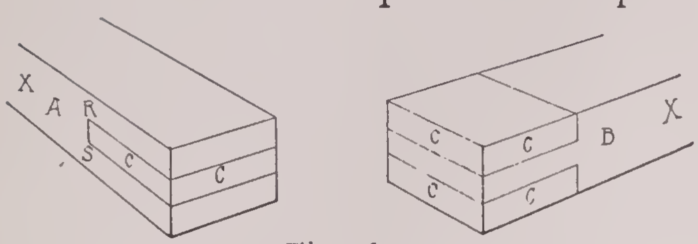


Fig. 76

Fix the stick A upright in the vise, with the narrow side toward you. With your back-saw cut downward to the mark RS, parallel to the end of the stick. Take care that the saw-kerfs do not extend outside the parallel lines. If you are not yet sufficiently expert in the use of the saw, you may saw a little inside the parallel lines, on each side, and afterward widen the mortise with a chisel; but you should aim to have such a complete mastery of the saw that after making these cuts no further work need be done on the sides of the mortise. Now take A from the vise and place it on a block of waste, with the narrow side, X, upward. Begin near the end of the stick, and with a sharp chisel, cut downward, chipping out the wood that remains between the saw-kerfs. As you near the bottom of the mortise, be careful not to cut below the line RS. Take pains to make the corners of the mortise square. If the sides of the mortise are not quite three inches apart, true them to the lines with the chisel, pushing and sliding the tool as you have learned to do. When finished, the mortise should be of the same width throughout, and its bottom should be at right angles to its sides and to the outer surfaces of the stick.

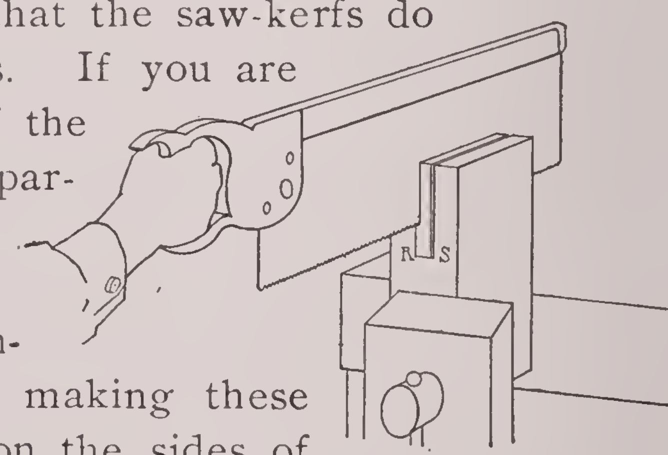


Fig 77

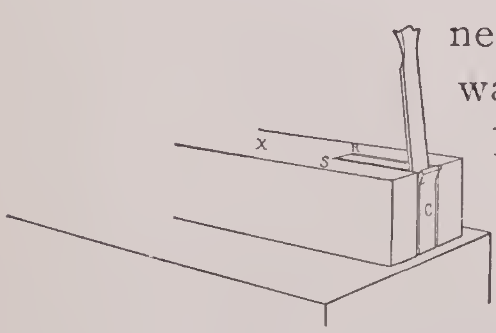


Fig. 78

To form the tenon, hold the stick B against the bench-hook and make a saw-kerf that will touch the line LM, in Figure 79. Turn the stick over and make another saw-kerf, NO. Now place the stick in the vise, the X side toward you, and with the back-saw cut to

the lines PQ and RS. The pieces C will then fall away from the stick. If the sawing has been correctly done, the tenon is ready for the mortise. Enter it in the mortise and see if it fits snugly and squarely at all points. If it does not, you may find it necessary to do some paring on the tenon with the chisel, but take off the wood very sparingly, for if you make the tenon even a trifle too small, it will slip loosely into the mortise and the joint will be weak, instead of strong. When the pieces A and B are fitted together, the mortise should receive the tenon so reluctantly that it may be necessary to drive the tenon into place with light blows of the mallet.

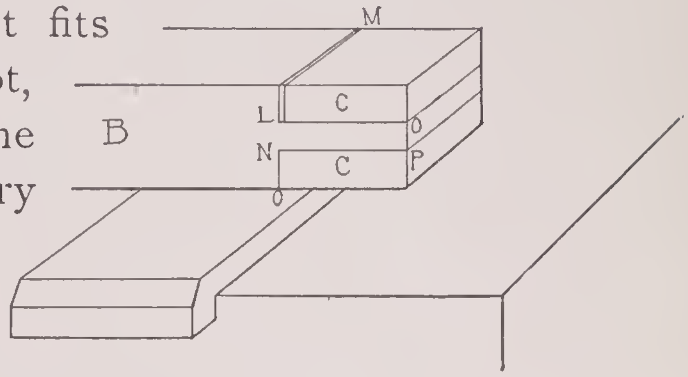


Fig. 79

Such a joint as you have just made is called an open mortise-and-tenon joint. This form of joint, or some modification of it, is used in putting together frames or other work where much strength at the corners is desired. You will readily see that two pieces of wood thus fitted together will retain their places, at right angles to each other, much better than if they were simply mitered and fastened together with nails. If glue is used to give additional strength to the joint, the two pieces cannot be taken apart without splitting or breaking them, unless they are first soaked in water.

The making of an open mortise-and-tenon joint is not very difficult, but we sometimes need to make mortises which are closed at both ends; that is, they cannot be entered from the end, but only from the face of the stick. In making a mortise of this kind, we cannot use the back-saw, and before the chisel can be used to cut out the superfluous wood, we must employ another tool. This is the bit.

## LESSON XV.—MORTISING: THE BRACE AND BIT

We will now make another mortise, using the brace and bit to do a part of the work. This is the first boring-tool for which you have found a use, thus far.

The common boring tools are the brad-awl, the gimlet, and the bit, which is a smaller size of the auger. A bit may be described as a spiral or screw chisel, adapted for boring holes through wood. It has a tapering, four-sided shank, which is slipped into the socket of the brace, where an adjustable clamp holds it firmly in place. The brace is a crank, with a flattened knob at the upper end to receive the pressure of the workman's hand or chest, while he rotates the crank with the free hand. Figure 80 shows the form of the brace

and of an ordinary bit. Bits whose cutting ends are of varying sizes and forms are made with shanks of the same size, so that they can be interchangeably used in one brace. See Figure 81. At the end of the bit is a short screw-point, or spur, which is pressed into the wood at the center of the circle to be described by the cutting edge. Immediately above the spur is the cutter, which is like a knife-point. As the bit is pressed downward, this knife-point, which is very sharp, revolves and scores the wood, and thus divides the fibers before the revolving chisel begins to cut deeply into them. The mission of the knife-point is to prevent the surface of the wood from being splintered, as it would be if the chisel plunged directly into it, and began tearing up chips before the fibers had been cut on the line of the circle.

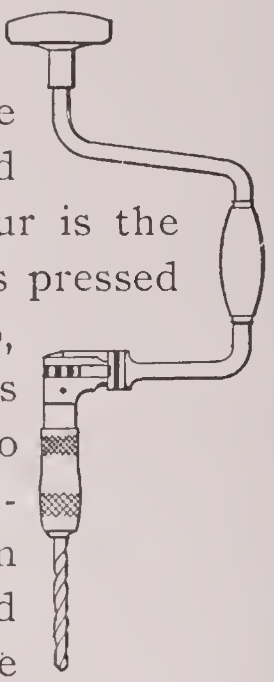


Fig. 80

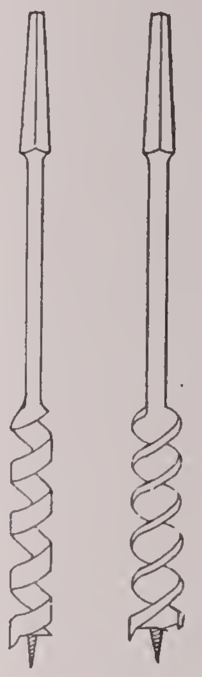


Fig. 81

Take a piece of waste wood and learn to use the brace and bit. Place the wood through which you intend to bore over another piece of waste. Push the spur of the bit into the wood and hold the tool upright, leaning over it and resting your chest against the left hand, which holds the handle of the bit. With the right hand rotate the crank of the brace from left to right. Do not bear down too heavily on the brace. The bit should cut its way through the wood without much pressure from above, if the bit is sharp and the wood is not too hard. In this case we are using a scrap of soft pine and little pressure will be required. Be careful not to suddenly bend the bit to one side or the other. Step back a pace, now and then, and, while you steady the brace with the left hand, look to see if the angle formed by the meeting of the bit and the surface of the block is a right angle. If it is not, the bit is not boring straight through the wood. When the spur pricks its way through the under surface of the wood, it will strike the block beneath and you will feel the impact. You can now press the wood you are boring firmly against the waste, and continue to rotate the crank until the chisel has cut clear through, but the last few turns should be made slowly, so as not to splinter the under surface when the bit cuts through it. Rotate the brace-crank from right to left, at the same time drawing it upward, and the bit will leave the hole it has made, bringing up the chips which have accumulated therein.

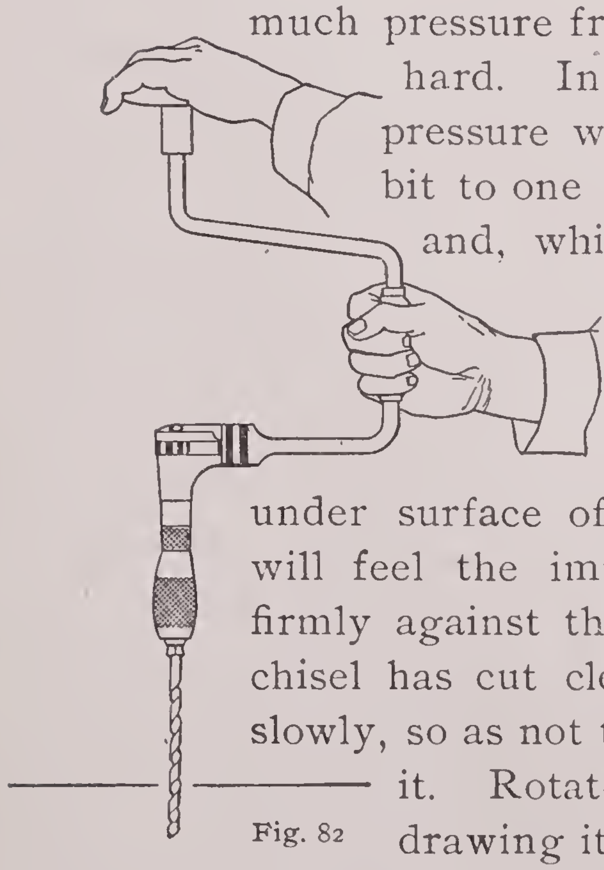


Fig. 82

Bore another hole in the same way, until the screw-point reaches the under surface. Then withdraw the bit, by rotating the crank. Turn the block over and enter the screw-point at the point where it

pricked through the wood from the other side. Carefully rotate the crank a few times and the bit will cut away the remaining wood and leave the hole open at both ends. This method does away with all danger of splintering the wood at either surface.

Having become familiar with the use of the bit and brace, you may proceed to the making of another mortise. Take a short piece of the 2-inch-x-3-inch stuff from which you cut the pieces for the mortise-and-tenon joint, and on the surface of the wood, mark out a rectangle one inch wide and two inches long, as in Figure 83. Repeat this rectangle on the opposite side of the stick, making it correspond in position to the rectangle previously drawn. To do this, you will need to use measure, gauge, and square, very carefully. Fasten the block in the vise, with the side toward you and the other surface resting against a piece of waste. The two pieces should be so firmly held together in the vise that neither can slip, and one end of the mortise should project beyond the jaws of the vise. Select a bit whose diameter is a little less than the width of the mortise and fix it firmly in the brace. Enter the spur of the bit midway between the side-lines of the mortise, and at least a quarter of an inch from the end. Hold the bit in a position horizontal with the floor, and rest the handle of the brace against your breast. Now rotate the crank, at the same time pressing forward, but not too heavily. When the bit has cut through the block and entered the waste piece, withdraw the bit, rotating it from right to left. Change the position of the block in the vise so that the other end of the mortise will project beyond the jaws, and bore a second hole, like the first. In boring these holes, be careful to keep the bit perpendicular to the surface of the block, otherwise it may bore in an oblique direction and cut away some of the wood outside the lines of the mortise. (Fig. 84.)

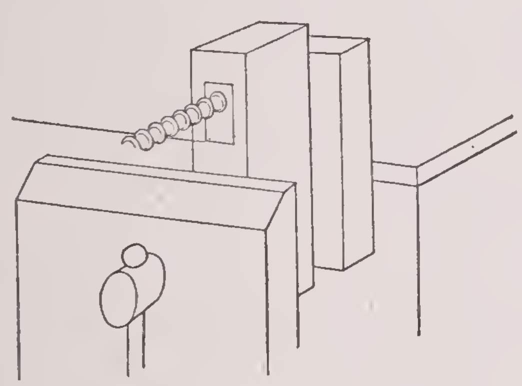


Fig. 83

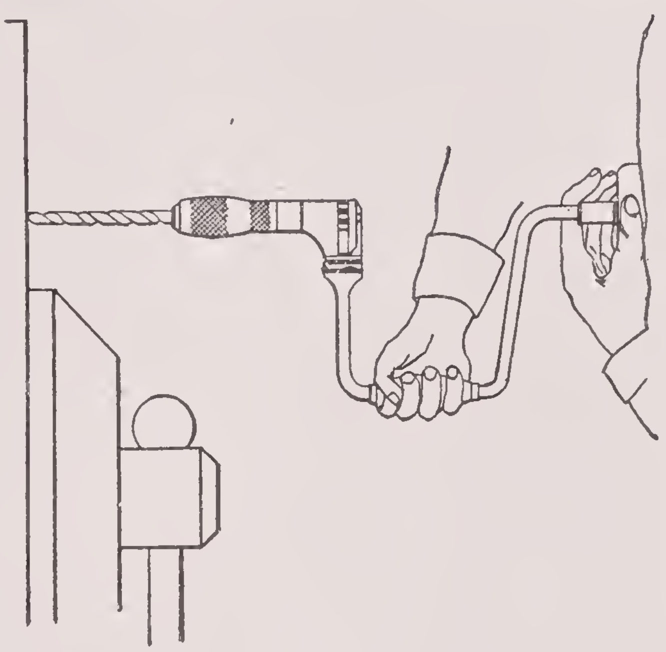


Fig. 84

Remove the block from the vise. You are now ready to use the chisel again. Place the block on the bench, and select a chisel not quite so wide as the mortise. Set the chisel across the grain, about

one-eighth of an inch from the near end of the mortise. The flat side of the chisel should incline slightly toward you. Drive it into the wood with a stroke of the mallet. Whenever you have occasion to drive a chisel with a heavier blow than can be given by the hand, remember to use the mallet, and not the hammer. The blow from your striking tool is transmitted through the chisel to the cutting edge, but a portion of the force employed is spent in the wooden handle. The iron or steel head of the hammer is more elastic than the softer wooden head of the mallet and the blow from it is sharper and more quickly spent. For this reason, hammer blows will soon cause the handle of a chisel to split, while the blows from the mallet do not injure it, except to bruise the end which receives the blow. (Fig. 85.)

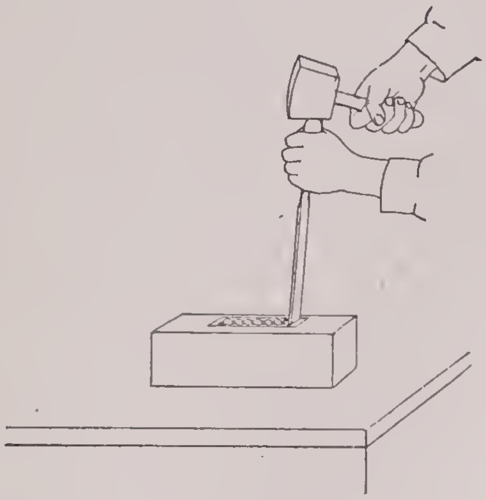


Fig. 85

After making the first cut, move the chisel forward, and make another cut. Then return to the first position and drive the chisel in again, when the chip between the two cuts will fly out and leave a gap. Cut away the wood from the sides of the mortise with a beveling stroke, so that the mortise will not be made too large by accident. The holes bored with the bit will made it easier for the chisel to get the greater part of the superfluous wood out of the mortise. When you have gone about half-way through the mortise in this way, turn the block over and work from the lines on the opposite side, in the same manner, until you again reach the center. The sides of the mortise will now be irregular and must be made smooth, perpendicular to the surface of the wood and parallel to each other, in pairs. To accomplish this, you will use the chisel for paring, taking off very thin shavings. (Fig. 86.)

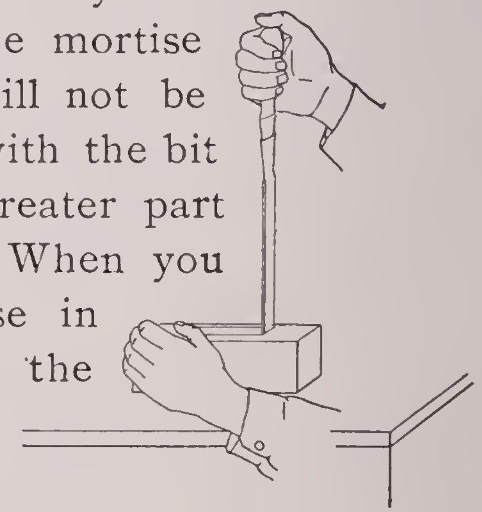


Fig. 86

Mark out and cut the tenon from another block, as described in the preceding lesson, and enter it in the mortise. The tenon must not fit too tightly in the mortise. If you have to use great force in driving it in, you may split the mortised block. Withdraw the tenon, if it fits too snugly, and you will see on its faces bruises where it has crowded against the sides of the mortise. Try the faces of the tenon with the square, and if they are plane, look for the corresponding bruises on the sides of the mortise and use the chisel very sparingly on these places.

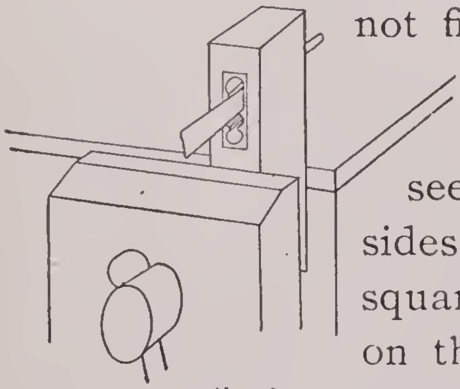


Fig. 87

There is another method of removing the superfluous wood from the mortise, after the holes have been bored with the bit. This is to insert a keyhole-saw in one of the holes (Fig. 87) and saw nearly to the

lines of the mortise. The sides are then pared with the chisel. This method is speedier than the one previously described, but does not afford as much practice with the chisel.

A blind mortise-and-tenon joint is one in which the mortise is sunk only part way through the wood. In this case, the end of the tenon does not appear at the outer surface of the mortised block but is hidden or "blinded" within the block. A common example of the blind mortise is that which is sunk in the stile of a door, to admit the lock. In making a mortise of this kind, holes are bored into the wood with the bit, care being taken not to bore too deep. The depth of the mortise should be marked on the wide surface of the block, and the bit removed from time to time, during the progress of boring, so that the depth to which it has penetrated may be determined. This is most quickly done by placing the finger against the bit, close to the wood, and laying off on the side of the block the depth to which the bit has penetrated, which may thus be compared with the depth proposed for the mortise. (Fig. 88.)

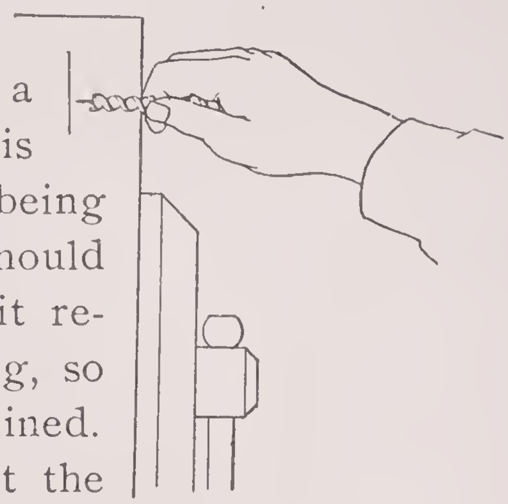


Fig. 88

When holes have been bored to the proper depth, the superfluous wood is removed with the chisel, as in making the mortise previously described, but care must be taken not to drive the chisel too deep. The depth to which it has penetrated must be frequently measured on the blade of the chisel and compared with the depth marked on the side of the mortise, as was done with the bit. The sides of the mortise must be pared smooth and perpendicular to the surface of the board. The bottom of the mortise will present a rough surface. By careful chiseling it may be made fairly even, but as it will not be visible when the tenon is inserted, it need not be perfectly smooth. In making the tenon, remember that the tenon will be shorter than the width of the side of the mortised block, and with the measure determine where the shoulder should come, in order that it may fit snugly against the block.

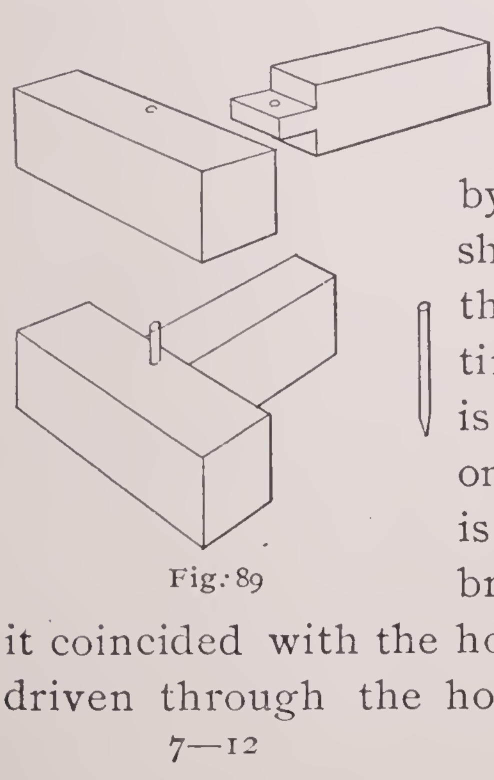


Fig. 89

The tenon is sometimes secured in the mortise by driving a wooden peg through both blocks, as shown in Figure 89. A hole is bored through the mortise with a small bit. This hole continues to the farther side of the block. The tenon is then inserted in the mortise and a mark made on it opposite the center of the hole. The tenon is then withdrawn and a hole bored in it a hairbreadth nearer the shoulder than it would be if it coincided with the hole in the mortise. A tightly-fitting peg is then driven through the hole and pared flush with the surface on either

side. As it passes through the hole in the tenon, it serves to draw the tenon more snugly into place, on account of the variation in the position of the holes in the mortise and the tenon. It will now be impossible to withdraw the tenon unless the peg is first removed from its place.

You should make several mortise and tenon joints, in the manner described, until you have obtained full control of the chisel, and of the brace and bit as well. Then you may take up another form of mortising.

## LESSON XVI.—END DOVETAIL

In the mortises and tenons you have made up to this time, all the lines have been at right angles to the adjacent lines. Unless the joints have been fastened with pins or glue, it is possible to pull the tenon from the mortise by exerting force in the direction shown by the arrow in Figure 90. Suppose, however, that we do not wish to pin or glue the joint, and yet the tenon-piece B is to exert a strain in the direction of the arrow. To make a joint that will withstand the strain and hold the piece B firmly to A, we form a dovetail. The dovetail is so called because its outline resembles that of a

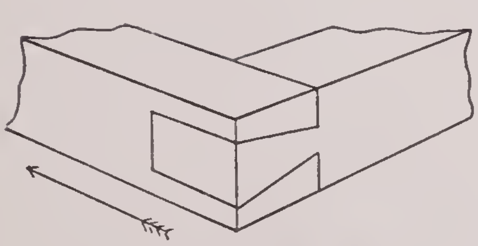


Fig. 90

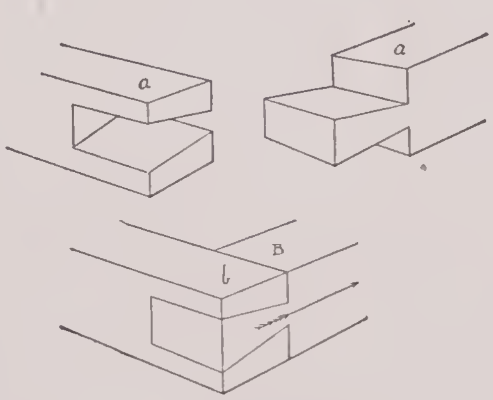


Fig. 91

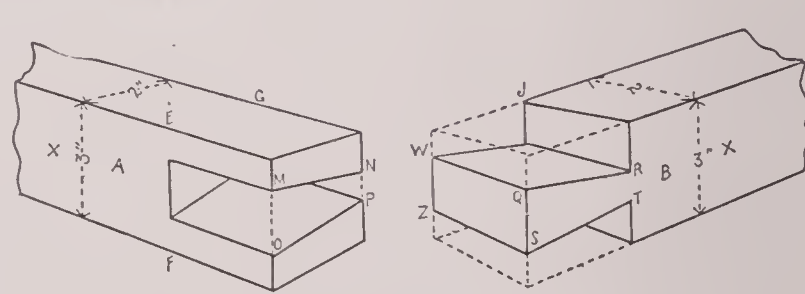


Fig. 92

dove's tail, when spread. You can see plainly that if we fit the tongue at the end of B into a hole of similar outline in A, as in Figure 91, the piece B cannot be withdrawn by pulling it in the direction of the arrow.

Let us make an end dovetail. Select two pieces of wood, A and B, of 2-inch-x-3-inch stuff, and plane them perfectly smooth and square. On the wide side of A, marked X lay off the thickness of the piece B, 2 inches, as shown by the line EF in Figure 92. Carry this line around the stick, at right angles to each adjacent surface, as EG. GH and FH are hidden in the illustration. In the same way mark the thickness of the piece A, 2 inches, on the piece B, and carry the lines around the stick, as in JK, KL. Now draw the oblique lines MN, OP, and QR, ST, on the end of A and

on the X side of B. These lines should start from a point at least half an inch from the corner of the stick and slant inward toward its center. They should not meet within the surface of the stick, however. There is no rule for fixing the angle. In some cases it is greater and in other cases less. In this case we will begin the line ½ inch from the edge and carry it to a point one inch from the edge, on the line KL. The lines MV and OY should be drawn to EF, parallel to each other and to the edges of the stick, and QW, SZ in the same way.

On the piece A the wood within the lines VMN and YOP is to be cut away, and on the piece B the wood outside the lines WOR, ZST will be discarded. Mark a few X's on the parts that are to be cut away.

We will first form the tenon on the piece B. Fix the stick firmly in the vise, with the line QR perpendicular to the floor, and with the back-saw cut very carefully on WQ, along QR, as far as R. Now change the position of the stick in the vise, so that the line ST will be perpendicular to the floor, and saw as far as T. Remove the stick from the vise, place it against the bench-dog, and saw to the lines JKR, LT. The pieces outside the tenon will drop away. If the corners at R and T are not clean and sharp, make them so by paring carefully with the chisel. Place the tenon against the marks on the piece A, and see that its outline coincides with TMN, YOP.

Now place the piece A in the vise and saw on the lines VMN, YOP as before. Take the stick from the vise and place it on a waste-block, X side upward. With a chisel, you can now split out the superfluous wood (xxxx) between the saw-kerfs and pare carefully to the cross-line VY. Remember that the end of the mortise, the upper edge of which is represented by VY, must be perpendicular to the surface X.

The pieces A and B will now appear as in Figure 93, *a* before they are joined, and *b* after they have been joined. It is plain that they cannot be separated except by drawing the piece B toward you; a pull in the direction of the arrow will not separate them. In this way, by altering the position of the dovetail, the two pieces may be joined so as to resist a strain from any direction. Make several dovetail joints like that already made, changing the position of the dovetail each time.

## LESSON XVII.—DOVETAILED BOX

We are now ready to do some further work on the box, the pieces of which we laid aside after cutting off the strips in which the nail-holes appeared. As some time has elapsed since the pieces were laid aside, examine them carefully to see whether they have shrunk or warped. If such is the case, remove any "winding" that exists, as you learned to do in a previous lesson. This will reduce the size of the box somewhat. We will suppose, however, that the pieces are smooth and plane on all sides, and are ready to be put together.

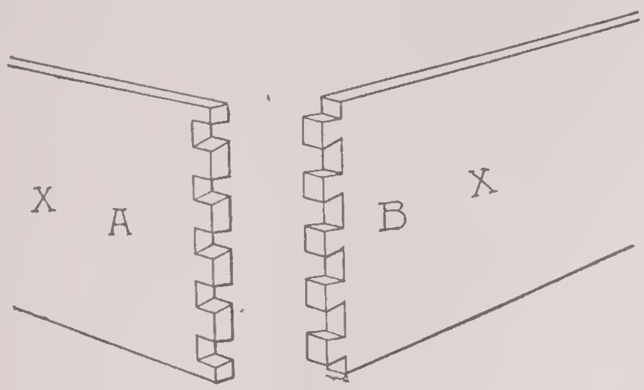


Fig. 93

Instead of nailing the sides together, as we did before, we will put them together with dovetail joints. In Figure 93, A represents one of the end-pieces of the box and B one of the side-pieces. On the end of A we will cut five dovetails, or mortises, to receive five tenons or pins which we will form on the end of B. Select the working face of A and B and mark an X on each. Before beginning work on the box, you should make a working drawing. Figure 96 shows a working drawing of the end-piece A, and the side-piece B; also the plan of the box. You should make a drawing like this. First determine the angle at which the oblique lines of the tenons shall be drawn. As already stated, there is no rule for determining this angle, but in fixing it you should aim to secure the greatest strength possible for the joint to be made. If the base of the tenon is too small, the tenon will be weak. Set your bevel at various angles and mark out dovetails of different shapes on a piece of wood. Select the form that seems to promise the greatest strength, bearing in mind the liability of the wood to split when subjected to a strain, if the pins or tenons are too weak. The form shown in the illustration is a good one.

Mark off on the X surface of the end-piece A, the thickness of the side-piece B, as shown by the line EF. On this line mark off eleven spaces. That from E to *d* will be half the distance from *d* to *e*, or *e* to *F*; *ef*, *gh*, *hi*, *ij*, *jk*, and *kl* will be equal to each other, and *l*F will be equal to E*d*. Having marked the eleven spaces, draw, from the end of the board, lines to meet *d*, *e*, *f*, *g*, etc., which will be at right angles to the end of the board and parallel to each other and to the sides. (Figure 94.) Make little X's on the wood which is to be cut away. Now, for convenience, put the board in the vise, end upward, and fix your bevel at the angle which you have determined upon for the oblique lines of the dovetails. Hold-

ing the bevel so that the apex of the angle is at *m*, draw *mn*, *op*, etc., on the end of the board. Then, with the bevel reversed, and the apex of the angle at *q*, draw *qr*, etc. Mark X's on the wood to be cut away. The end of the board will now appear as in the illustration. Take the board from the vise, and on the face opposite the X side, draw lines to correspond with those first drawn, *dm*, *eq*, etc. This completes the marking of A, but before cutting it we will mark the side-piece B.

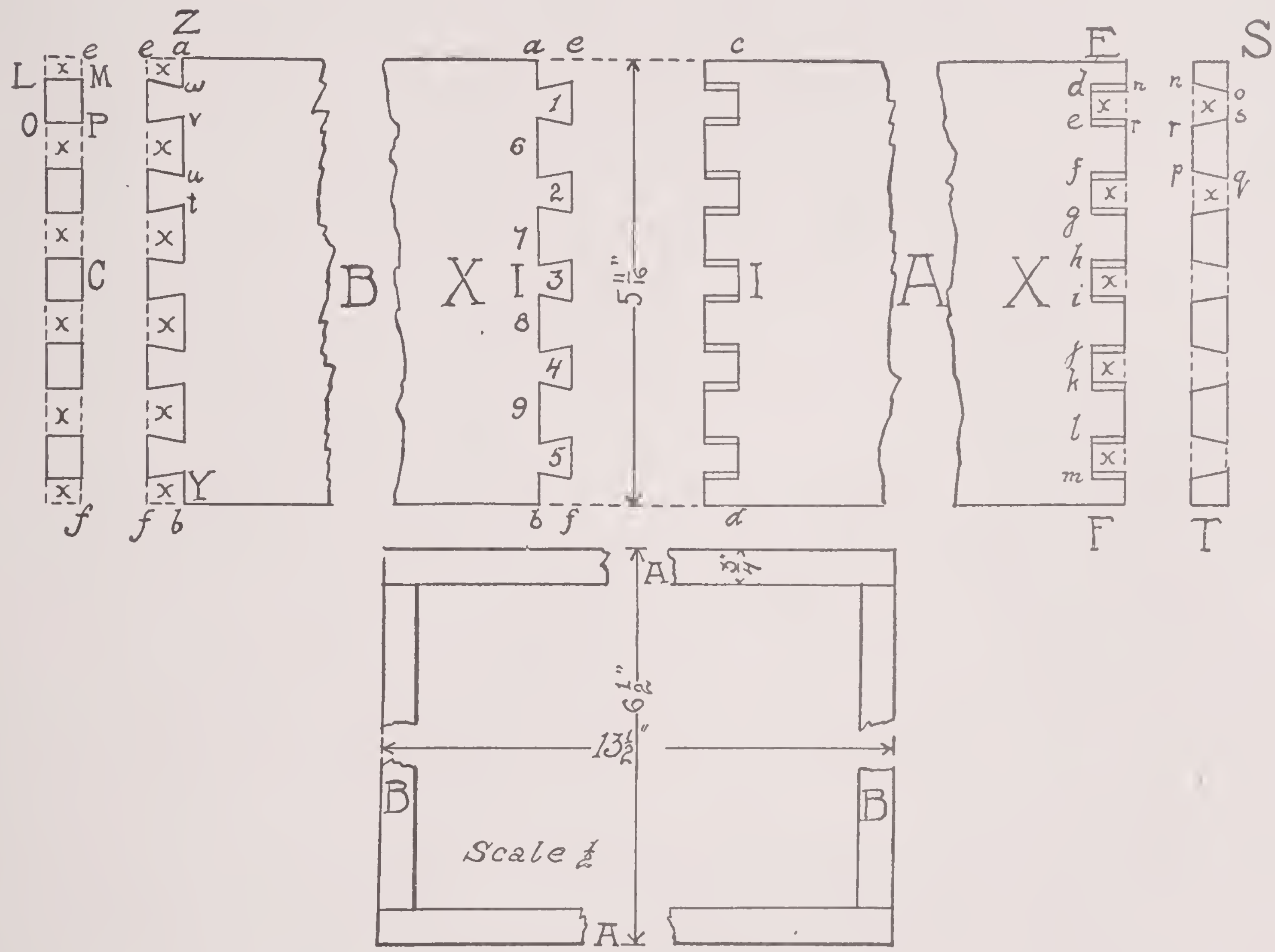



Fig. 94

On the X side of B lay off the thickness of A, as shown by the line ZY. It is against this line that the inner edge of the end-piece, represented by ST, is to come when the joint is made. The space Z*w* will therefore correspond to S*n*, the space *wv* to *nr*, the space *vu* to *rp*, etc. With your dividers, measuring from Z, lay off these spaces on ZY.

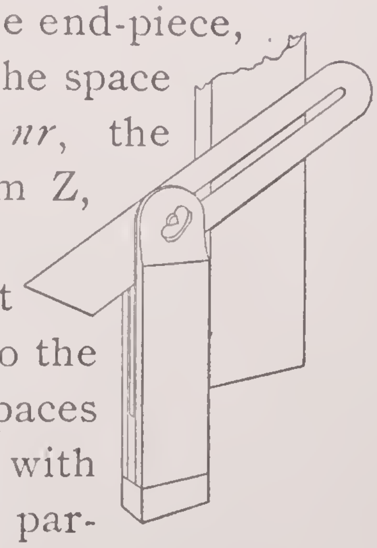


Fig. 95

Without altering the angle of your bevel, place it against the end of the board and draw lines from *w*, *v*, *u*, *t*, etc., to the end of the board, as you did before. Mark the waste spaces with X's. Now fix the board upright in the vise, and with the square draw the lines LM, OP, etc., which should be parallel to each other and perpendicular to both faces of the board. Mark the waste spaces with X's and then repeat on the other face of the board the lines previously drawn on the X face.

Place the piece B against A, and see if the lines of the dovetails to be cut in the one coincide with the pins of the other. When you are satisfied that they are correctly marked, repeat the work on the ends joining the three other corners of the box. It is well to mark out all the work before beginning to cut.

You already know how to do the cutting. The back-saw is used to make saw-kerfs on the oblique lines extending from the edge of the board inward, and the chisel for chipping out the waste between the saw-kerfs. This work must be done with great accuracy or the pins and dovetails will not mate. When properly done, the end of each board will be flush with the adjacent surface, and no spaces will show between the pins and the dovetails. As now fitted together, the box is securely fastened at the corners. The end pieces cannot be pulled away from the sides. The sides cannot be separated from the ends except by exerting equal force at both ends of the box at the same time, and even this will be very difficult, if the pins and dovetails fit closely together.

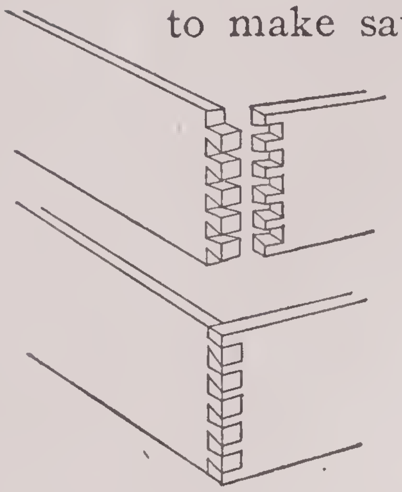


Fig. 96

We will, however, make the box doubly strong by gluing the joints, and as gluing is an important feature in woodwork, we will take up the subject in another lesson.

## LESSON XVIII.—GLUING

The glue used in woodwork is chiefly of two kinds, animal glue, and fish glue. Animal glue is made from bones, horns, and hoofs, which, when boiled, yield a sticky substance. Fish glue is made from the entrails and spawn of fish. Glue may be had in liquid form, ready to apply cold; but we will use that which is bought in cakes or chips, to be dissolved in water and heated before it is ready for use.

Break the glue into small pieces and let it soak for several hours in cold water. The water should barely cover the glue. If the glue is soaked over night, it will be soft in the morning, and ready for boiling.

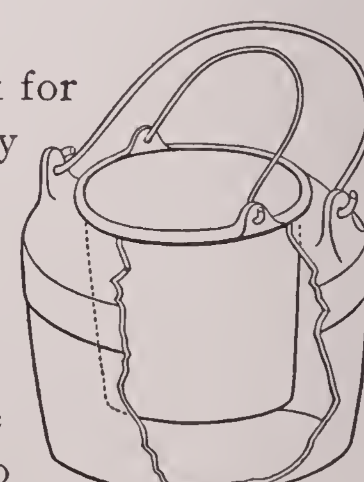


Fig. 97

The glue-pot consists of two parts, an inner pot, in which the glue is placed, and an outer pot which is partly filled with water. A rim on the edge of the inner pot prevents it from dropping to the bottom of the water-pot, and it is thus suspended in the water. You must take care that the water in the outer pot does not boil away; if it does, the glue will burn. So long as the inner

pot is immersed in water, the heat of the glue will never rise above the boiling temperature of water, and this keeps the glue from burning.

Whittle out a small wooden paddle and use it to stir the glue from time to time, while it is boiling. The glue should cook slowly for an hour or two, in order that the chips may be thoroughly dissolved, so as to make the glue of even consistency. It is important to have the glue of the proper consistency when it is applied to the wood. If it is too thin, it will be absorbed by the wood and will not hold the pieces together. If it is too thick, or too cold, it will form a layer over the wood and prevent the two pieces from touching each other. When the glue hangs persistently to the paddle and forms slowly in large globules, it is too thick. More water should be added and the glue should be boiled again. If it is too thin, further boiling will cause some of the water to evaporate and reduce the glue to the right consistency. When it reaches this point, it will run from the paddle — not in drops, like water, but in a smooth, even thread.

The glue should be hot when applied, and in order that it may not be chilled when it comes in contact with the wood, warm the wood, by holding it near the fire. Have your brush ready and saturate it thoroughly with the glue.

While your glue is making ready, put your dovetailed box together and adjust two handscrews so that they will grip the sides of the box, as in Figure 98. Be careful to have the pressure from both

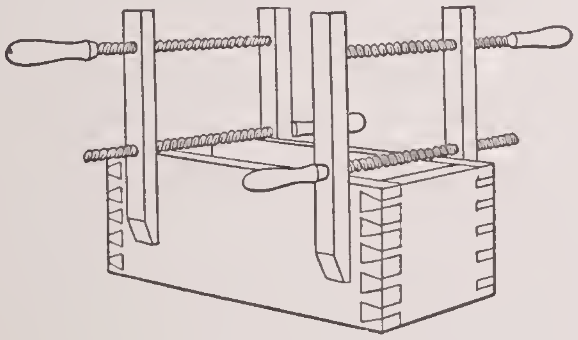


Fig. 98

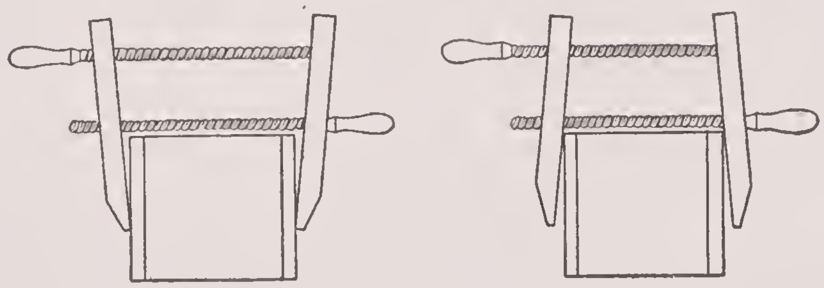


Fig. 99

jaws of the screw come squarely against the side of the box. If the upper screw is tightened more than the lower one, the jaws will spread apart at the bottom and the pressure will come on the upper edge of the box, as in Figure 99. If the lower screw is tightened too much, the pressure will be exerted nearer the bottom of the box and the sides will not be held squarely against the ends *b*. By loosening and tightening first one screw and then the other you can secure an even pressure at top and bottom. When the handscrews have been properly adjusted, loosen them a little, remove them from the box, and lay them near by, where they can be quickly reached after the glue has been applied.

Number the corners of the box so that they can be quickly readjusted in their proper positions, and take the pieces apart. Warm the pieces by placing them in front of the fire, or on top of the stove, turning them frequently so that one side may be heated as much as another. If you place them on top of the stove, you will, of course, rest them on thin strips of waste, so that they may not be burned by direct contact with the hot iron. When they have been thoroughly warmed, lay them on the bench, one above the other, in the order in which they are numbered.

The glue must be applied quickly, but not carelessly. Brush the glue over the pins and dovetails, taking care that none gets on the parts that are to face outward when the box is put together. Join the end-pieces to one of the side-pieces and then add the remaining side-piece. If you join both side-pieces to one of the ends at first, you will have to spread them apart at the other end to admit the remaining end-piece, and in doing this some of the pins may be cracked or broken. In putting the pins and dovetails together, it may be necessary to drive them into place with the mallet, and if so, the blows should be delivered on a block of wood held against the side of the box.

As soon as the four pieces have been glued and joined, apply the handscrews at a distance of an inch from the corners, and tighten them. Some of the glue may be forced out of the joints. Do not allow it to remain on the surface, but wipe it away with a cloth wet with hot water. If you allow the glue to dry on the surface, it will be hard to remove it without defacing the box.

It is a good plan to go through the form of doing this work with a dry brush, before you apply the glue, so that you may not be confused when you come to do the actual gluing and must work quickly.

When the box has been glued and tightened with the handscrews, place it on the bench and see if it is square and without winding. If it is a little out of shape, loosen the screws, press it into correct position and again apply the screws. You must do this before the glue "sets."

Put the work away and allow it to remain undisturbed for several hours. The glue will then be thoroughly dry and the corners so firmly joined that they cannot be separated except by soaking them in water.

## LESSON XIX.—FINISHING THE BOX

When the glue applied to the dovetailed joints has thoroughly dried, the handscrews may be removed and the box will be ready for finishing. The edges of the bottom should be planed square and

smooth. Be careful not to splinter the edges of the end-pieces when you plane across the grain of the wood at the corner of the box.

The bottom of the box may now be glued to the sides, for further practice in gluing; but it will be well to secure it with a few nails, along the sides and in the center of the ends. Do not drive nails too near the dovetails, lest they be split.

The upper edges of the sides may now be dressed, and the box should be of the same height at all points along the sides and ends. Make it so, if necessary, by planing. Now finish the sides of the box with a smoothing-plane, being careful about planing across the dovetails at the corners. If there are any very rough spots, reduce them with the scraper. If any glue appears on the inside of the box, at the corners, remove it with a sharp chisel. You cannot use the smoothing-plane on the inside of your box, so the inside may be dressed with sandpaper.

Sandpaper is often a valuable help to the wood-worker, but it should not be used when the smoothing-plane will do as well. Never hold the sandpaper against the wood by direct pressure of the hand, when you are using it on a plane surface. If you do so, it will be pressed unevenly against the wood and will make the surface more or less uneven. It also tends to destroy the sharp corners, and should be used sparingly.

To use it properly on the inside of your box, fold a piece of the sandpaper about a block of wood and, grasping the block at the sides with the thumb and fingers, rub it back and forth over the wood. Be careful to keep the block flat on the surface of the wood, as you would a plane, so that the sandpaper will cut with its entire surface and not simply with the edge where it is folded about the block. It may be difficult to finish neatly in the corners of the box, but if the sides of the block have a beveled edge and the sandpaper is drawn tightly against it, you will be able to sandpaper close to the joint.

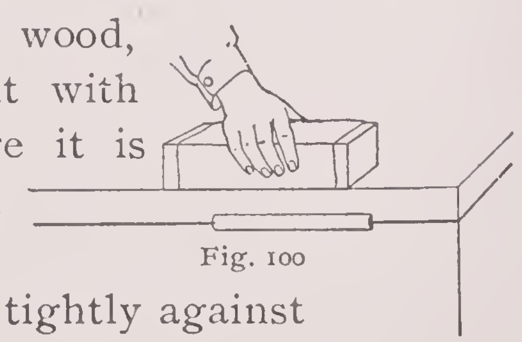


Fig. 100

If the sandpaper is so coarse that it leaves scratches on the wood, it is manifestly unfit for the work you are doing and should be replaced with sandpaper of a finer grade. Do not let the sandpaper incline against the edges of the box or it will round them, more in one place and less in another. Should you find that you have done this, restore the sharp edge with the smoothing-plane.

The box is now ready for the cover, but instead of nailing it in place, we will fit it with hinges, so that it may be easily opened and closed.

## LESSON XX.—THE BOX COVER—HINGES

A metal hinge has two leaves, or straps, each of which has rounded projections, or knuckles, along one edge, and these knuckles alternate with similar knuckles on the other strap. The knuckles are perforated, and through them is passed a pin which holds them together and upon which they revolve. In a door-hinge this pin is removable, but in the small hinges which we are about to use on the box, the pin is permanently fixed in place. The straps of the hinge are pierced to admit of passing screws through them for holding the hinge to the wood. Figure 101 shows a hinge of this character. The upper half of the hinge is to be sunk in the top, and the lower half in one of the edges of the box, so that when the lid is closed, it will meet the sides properly.

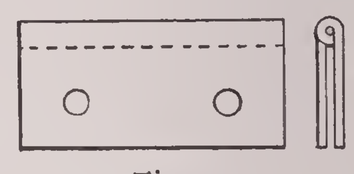


Fig. 101

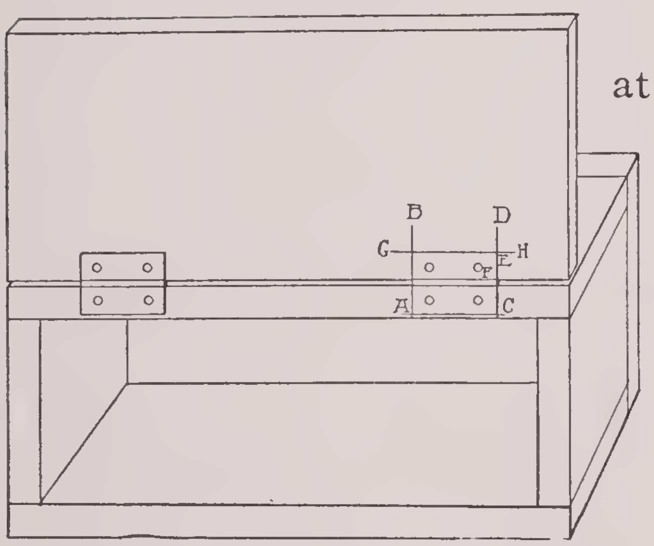



Fig. 102

Place the two hinges on the back edge of the box, at equal distances from the ends, but not too near the center. With your measure, determine accurately where the edge of the hinge is to be. Mark the length of the hinges on the edge, and with pencil and square draw lines across the edge at these points, AB, CD, in Figure 102. Now find the width of the hinges on the edge, which will be equal to the distance from the center of the pin to the edge of the hinge, because, when the hinges are in place and the cover is closed, the center of the pin will be in line with the outer surface of the back side and the edge of the cover. Draw lines to show the width of the hinges, EF.

Now hold the top against the back, flush at both ends, and set off the length of the hinges on the inner surface of the top. With the gauge find half the thickness of the folded hinge, by measuring from the center of the pin to the surface of the end that is to meet the wood, and mark this on the edge and the top, as shown by the lines GH. Each strap of the hinge is to be sunk in the wood so that when the hinge is closed, the cover will touch the edges of the box at all points. It must not be sunk too deep, or the cover will be tilted up from the back; and if it is not sunk deep enough, the cover will not meet the back edge of the box, and will be tilted slightly forward.

Having marked the positions of the hinges, as described, cut to the lines with the chisel. This is done exactly as in paring the mortises, in the preceding lessons. Use a sharp chisel. First score the wood across the grain. Then drive the chisel straight downward

along the lines AB, CD, with light blows of the mallet. Pare the sides of the mortise, being careful to keep within the lines and not to cut too deep.

Now put the folded hinges in place on the edge of the box and lay the cover in place. See if the hinges fit perfectly in the mortises and if the cover touches all sides of the box. If it does not, the mortises should be sunk a trifle deeper. Lay back the top, and holding the hinges in place against it and against the back side of the box, see if the edge of the top just meets the edge of the back. If it is separated from the back at one end, the hinge-strap does not go far enough toward the inner edge of the back or the outer edge of the cover. Pare away the wood so as to make the mortise a trifle wider.

When you find that the mortises have been correctly made and the hinges fit properly in their places, lay the hinges in place on the cover of the box, and make a small hole with an awl in the center of the wood defined by the holes in the hinges. The awl-hole will serve to « center » the screw when it is driven in.

You will notice that the holes in the hinge are countersunk on the inner side; that is, the edge about the hole has been beveled. This is to admit of driving the screw in until its head is flush with the surface of the hinge-strap. The screw-head should fit neatly into the holes, and the screws should not be so long that they will project through the upper surface of the box-cover, when they have been driven home. Place the point of the screw in the awl-hole and give the head a tap with the hammer to settle it in place. Fix the screw-driver point in the brace and drive the screw home. If your brace is not supplied with a screw-driver point, use your small screw-driver with wooden handle. A screw can be driven straight more easily with the brace than with the common hand screw-driver.

When the hinges have been screwed to the back edge of the box, lay the cover on the bench and place the box on its side so that the upper straps of the hinges will fit into their places. Set the screws and drive them home.

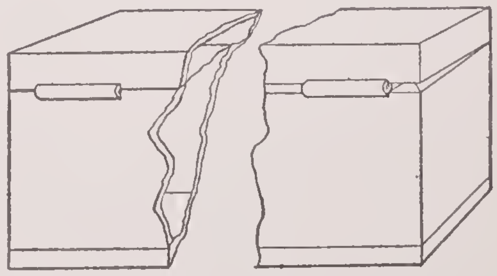


Fig. 103

Now let us see how the box looks. If the hinges have been properly set, the cover will be flush with the sides of the box all the way around, and will meet the upper edges at all points.

If the hinges were not sunk deep enough in the wood, the cover will not come close to the box at the back. If they were sunk too deep, the cover will not meet the front edge of the box, and if you force it down, the strain will pull the screws from their places and perhaps splinter the wood. If the hinges have not been set far

enough toward the inner side of the box, they will project from the back so far as to look ungainly, and when the cover is thrown back, there will be a wide gap between it and the back of the box. If the hinges were set too far in, toward the front of the box, the cover will crowd against the back as soon as it is lifted, and if forced back the hinges will be torn off. If one hinge has been set correctly, and the other too far out, the cover will not be flush with the sides of the box.

If you find that any of these faults exist, examine the hinges carefully and see whether they have been set correctly on one piece,—the edge of the box, we will say,—while they have been incorrectly set on the top. In this case it will be necessary to reset only the straps which are fastened to the cover. Take out the screws. First plug the screw-holes, by driving in wooden pegs which fit tightly. They should be dipped in glue before they are driven in and should then be cut off close to the surface. When the glue has set, you can replace the hinges, after adjusting them properly. If the hinge was sunk too deep, when first set, place one or two thicknesses of cardboard, or a shaving, under it, in order to raise it. If it was not sunk deep enough, pare the bottom of the mortise with the chisel. Use the chisel to widen the mortise, if that is necessary. Having adjusted the hinges, screw them in place as before, using the awl to make the centering hole. You will see now why it was necessary to plug the original screw-holes, so that the screw could be driven home in a new position, without danger of its being diverted into the hole first made.

You may now fit a hook to the front of the box. Find the center of the front edge of the cover and drive in a brass nail, with rounded head, letting it project an eighth of an inch from the wood. A small screw-eye may be used instead of the nail. Screw the hook to the side of the box so that the tongue will fit snugly over the nail or in the screw-eye. The hook should have a small shoulder on the inner side, or a washer, to allow of its turning freely without rubbing the side of the box.

Your box is now completed, so far as the woodwork is concerned. But the wood will soon become soiled, if handled often, unless it is stained or varnished. You will do well, therefore, to give it a coat of shellac varnish, which is made of white shellac dissolved in alcohol.

First sandpaper the box with fine sandpaper and wipe it free from dust with a clean cloth. The varnishing should be done in a warm room. Apply one coat of varnish with a flat brush, drawing the brush over the wood with smooth, straight strokes. Do not take up too much varnish on the brush at one time, and do not

let the varnish run down the sides and form streaks. Shellac varnish sets quickly, and you should avoid going over the parts where the varnish has begun to set, as the brush will break up the smooth surface. When the first coat is thoroughly dry, which will be within forty or fifty minutes if the room is warm, rub it down with the finest sandpaper, stretched over a block. Do not sandpaper too deep, but only enough to leave a perfectly smooth surface. Now give the box another coat of shellac, and let it dry.

The varnish will keep out the moisture and prevent the wood from warping or shrinking. Finger-marks or other soiled spots may be wiped off with a damp cloth and the box will have a neat, glossy appearance.

## LESSON XXI.—MAKING A PANELED DOOR

For what reason is a door made of several pieces of wood, sometimes ten or twelve in number, rather than of one solid piece? A door is intended to fit neatly into a frame. We have already seen that wood has a tendency to shrink and warp, and although it may have been once thoroughly seasoned, it will warp and shrink if subjected to alternate moisture and heat. Even within the house, the amount of moisture in the atmosphere varies according to the state of the weather outside, and all woodwork, therefore, is subject, more or less, to shrinking and warping. To reduce to a minimum the effect of this shrinking and warping, doors are made of several pieces of wood, fastened together in such a way that the door will retain its shape and continue to fit snugly in its frame, notwithstanding the changes from dry to damp weather.

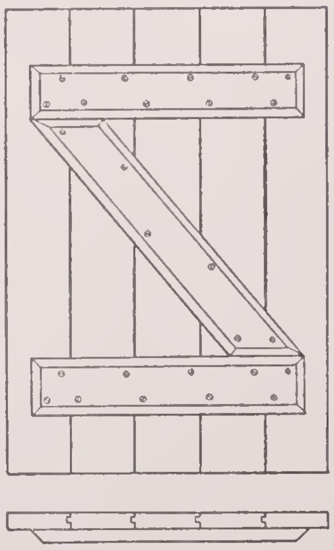


Fig. 104

Doors are made chiefly in two forms—the battened and the paneled door. The battened door is made of boards running up and down, and held together by crosspieces called battens, which are fastened to the several boards in succession. Figure 104 shows a battened door in which a diagonal cleat has been added to the cross-strips. This is to prevent the boards farthest from the hinges from dropping down by their own weight and pulling the door out of square. If the door were made in one solid piece, it would warp, as in Figure 105, which would throw it so much out of shape as to make it useless. But it is made of narrow boards, and as each board warps by itself, the result appears the same. This, as you see, causes but little change in the shape of the door. Wood

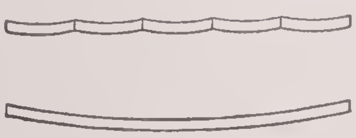


Fig. 105

shrinks in width considerably, but practically none at all in length. If boards that have been thoroughly seasoned, and have therefore shrunk to their least width, are placed close together and battened, they will swell, after being exposed to moisture, and increase in width. Expanding wood exerts great force, and this would cause the door to be thrown out of shape. It is necessary, therefore, to leave narrow spaces between the boards, in order to give the boards room to expand.

But this does not make a door tight enough to keep out wind and rain. To overcome this difficulty, the door is made of boards whose edges are "tongued and grooved." On one edge, a narrow slit, or mortise, is cut, running the entire length of the board, and on the other edge is a tongue, or tenon, which fits into the mortise on the adjacent board. Figure 106 shows the plan of the end of a door made of such boards. Now, when the door shrinks, the tongue will draw out a little from the groove, but without leaving an open crack. When the wood expands again, the tongue will be pushed farther back into the mortise, and, as the pressure is unresisted, the door will not be thrown out of shape. A battened door of this kind may be quickly and easily made, but it is not especially ornamental, and is therefore used only on barns, outbuildings, and like structures where ornament is not essential.

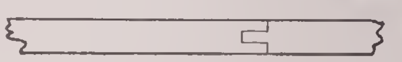


Fig. 106

We desire to have our home surroundings as attractive as possible; therefore, in dwelling-houses, as well as in office-buildings and the like, where regard is had for beauty of construction, doors are paneled instead of being battened. A paneled door consists of a framework of boards mortised together at the corners and grooved on their inner edge to receive a thinner board, called a panel. Figure 107 shows a paneled door. The two upright pieces are called stiles; the three cross-pieces, rails; and the panels are the boards inserted in the spaces between the rails and the stiles.

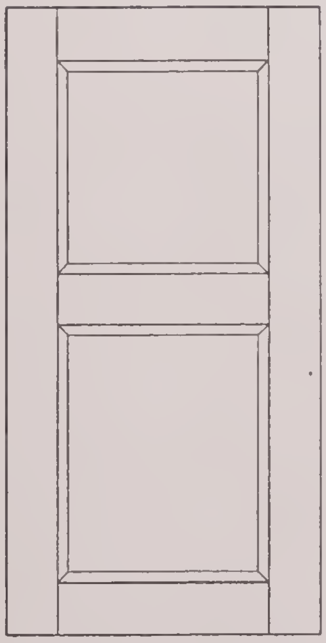


Fig. 107

The rails do not shrink perceptibly in length. The panels, when shrinking and expanding, slip back and forth in the grooves of the stiles. You will see, therefore, that the only measurable shrinkage in the width of the door will be that of the stiles. This gives little trouble, as compared with the shrinkage that would ensue if the door were made in a solid piece. The expansion of the rails and stiles is sometimes sufficient to cause the door to stick, after a season of wet weather, but the removal of a thin shaving generally causes the trouble to disappear.

You are to make a paneled door. First make a working drawing, like that shown in Figure 108. A represents the elevation, B

the plan, and C a cross section of the door on the line *cf*, showing the panel slotted in the stiles.

The next step is to get out the stock. You will need two upright pieces for stiles, each 30 inches long, and three pieces for the rails, each 15 inches long. Doors are generally made with the middle and bottom rails wider than the top rail, but it will serve our purpose as well to make the door with stiles and rails all of the same width, $2\frac{1}{2}$ inches. By reference to the drawing, you will see that the stiles project beyond the top and bottom rails, and the tenons of the rails project beyond the stiles. The mortises are to be cut very near the ends of the stiles, and to avoid splintering the ends and spoiling the work, the stiles are made longer than they are required to be when finished and shortened afterward. The projecting parts, or "horns," are to be cut off when all the parts of the door have been joined and it is ready for finishing.

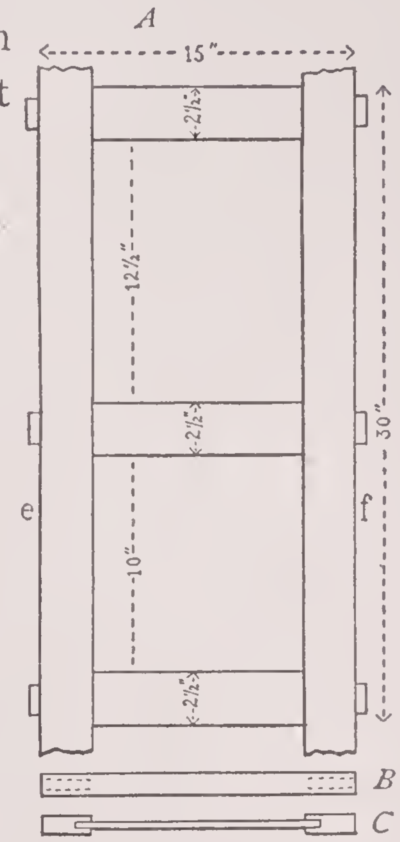


Fig. 108

In getting out the stock, therefore, it will be necessary to make the pieces for the stiles each 32 inches long, and the pieces for the rails each 16 inches long. As your pieces will have to be planed, you must allow for a slight reduction in width, when cutting the stiles and rails to width. If you use $1\frac{1}{2}$-inch stock, the surface planing will reduce it to $1\frac{3}{8}$ inches, which will serve your purpose.

For the panels, you will need two pieces of stock $\frac{5}{8}$ inch thick. These pieces must be longer and wider than the space between the rails and stiles, as the edges are to be chamfered to fit into the grooves on the inner edges of the frame. Make one piece, therefore, $13\frac{1}{2}$ inches long, the other 11 inches long. The width, 11 inches, is the same in both cases.

All your pieces are now sawed to length. Dress them with the jack-plane and smoothing-plane, as you have learned to do. Be careful to have all the parts of the frame of the same thickness when dressed. Do not forget to mark an X on the working edge and face of each piece, and to gauge from that edge in every case. Finish the ends true and square. When you lay the pieces on the bench, one against another, in the relative positions they will occupy when the door is joined together, they should fit snugly together, and all the angles, where they touch each other, should be right angles. Now you may undertake the jointing of the frame.

## LESSON XXII.—MAKING A PANELED DOOR—JOINTING

You have already learned how to cut a mortise and a tenon, so you will not be daunted by the problem of jointing the door. Nevertheless, you will need to work carefully, for a new feature enters into the making of the tenon. Before the panels can be fitted in their places, the inner edges of the stiles and rails must be grooved. You will not make these grooves just yet, but you know they are to be made, and you can see that if the tenon is made the full width of the rail, there will be left a hole between the shoulder of the tenon and the grooved edge of the door, as in Figure 109. To fill that hole, we must leave a projecting stud on the upper edge of the tenon, at the shoulder. The remainder of the tenon will not be so wide as the rail itself, because the mortise does not extend to the end of the stile, although the upper edge of the rail is to be flush with it.

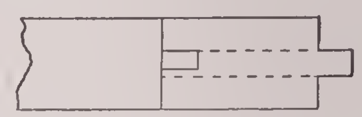


Fig. 109

You should first make «projections» of the ends of the stile and the rail, as in Figure 110. A projection is a drawing in which the hidden

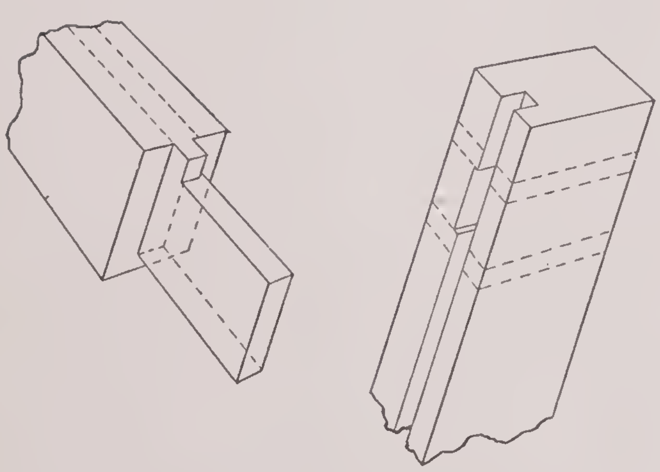
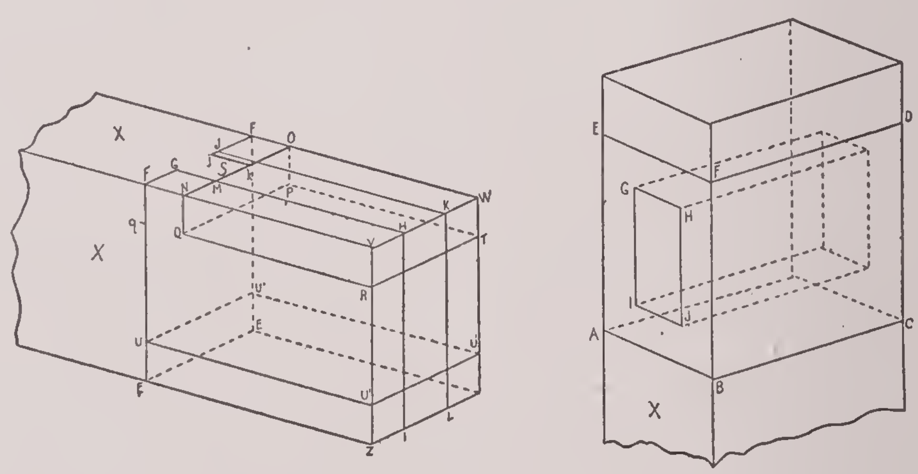


Fig. 110



A Fig. 111 B

lines of a solid object are represented by dotted lines corresponding in length and position to the invisible lines. In Figure 111, A represents the end of the stile, showing the groove for the panel, and the mortise. B represents the end of the rail and the tenon. S is the little stud that is to fit into the groove in the stile. As the groove is narrower than the mortise, the stud must be narrower than the rest of the tenon.

Figure 111A shows a drawing, to represent the end of the rail before the tenon has been cut, and then mark the rail. The tenon is to project $\frac{1}{2}$ inch beyond the stile, which is $2\frac{1}{2}$ inches wide, so you must set off 3 inches from the end of the rail and draw the line EF all the way around the board. The distance between this line and the inner edge of the opposite stile will be 10 inches; set

off 10 inches, therefore, and draw a similar line, which will be, of course, 3 inches from the farther end of the rail. These lines represent the position of the shoulder of the tenon at each end. They should be broken in the center, on the edge, so that the stud S will not be sawed away by mistake. The tenon is to be $1\frac{1}{2}$ inches wide and $\frac{5}{8}$ inch thick. With the gauge, find the position of the tenon and draw the lines GHI, JKL, the space between which represents the thickness of the tenon. From G lay off $\frac{1}{2}$ inch, GM, to indicate the length of the stud, and at right angles to this draw, with the square, NO. Using the square as a ruler, continue NO on the sides, making NQ and OP each $\frac{1}{2}$ inch long. With the gauge find R and T, making VR and WT equal to NQ, and draw QRT, continuing it to P. This line shows the cut that must be made to reduce the width of the tenon to less than the width of the rail. With the gauge find U, and draw VU, which will be $1\frac{1}{2}$ inches from QRT and parallel to it, showing the width of the tenon, and will also be $1\frac{1}{2}$ inches from EZ. Mark X's on the spaces of the wood, which are to be cut away.

This work should be carefully done, the gauge and square being constantly used and the usual care being given to the making of right angles where lines meet. The bottom rail should be marked in the same way. The middle rail will also be marked in a similar way, but as it is to be grooved and to receive a panel on either edge, no provision need be made for a stud. The line NOPQ may, therefore, be omitted and the line RQ continued to *q*.

It will be easy to mark the position of the mortise. Figure 111B shows the end of the stile before it is grooved. Draw ABC very lightly, all around the stile, $3\frac{1}{4}$ inches from the end. The bottom of the rail is to touch this line. Lay off $2\frac{1}{2}$ inches, the width of the rail, and draw the line EFD, which shows where the top of the rail will meet the stile. It will now be easy to find the position of the mortise. The lines GI and HJ will show the length of the mortise. IJ is $\frac{1}{2}$ inch from AB, and GH is $\frac{1}{2}$ inch from EF. The distance between them is $1\frac{1}{2}$ inches. GI and HJ are found by the gauge, set to the same width as in drawing GH and JK, in Figure 111A. Having marked out the mortise on opposite sides of one end of the stile, repeat the marking on the other end. A mortise is now to be made for the middle rail. The upper edge of the middle rail will be $12\frac{1}{2}$ inches distant from the lower edge of the top rail, or from AB in Figure 111B. From AB lay off $12\frac{1}{2}$ inches and draw a line around the stile at this point, with the square. A second line, $2\frac{1}{2}$ inches below the first, may be drawn, and the mortise centered on the edge of the stile, between them.

When the tenons and mortises have been marked for the ends of both stiles and the three rails, you may proceed to the cutting. Fix the rail upright in the vise and with the back-saw cut GHI, JKL, Figure 111. Next cut $UU^1$ and QRT. Be careful not to cut beyond Q, or you will shorten the stud S. Now cut QNOP and then EFJ, EFG. The waste pieces have now been removed, but the stud is of the same thickness as the tenon. A portion of it must be pared away, at JK, in order that it may fit into the groove in the stile, which is narrower than the tenon. This paring may be done with the chisel, but you will do well to delay the paring until you have cut the mortises and grooved the boards.

You have already learned how to cut the mortise. This may be done by making holes with the bit and then paring with the chisel, but as the mortise is narrow, the bit must be operated very carefully or it will cut into the sides, if it is not held perpendicular to the upper edge of the rail. It may be better to cut the mortise with the chisel alone. In this case you will need to hold the rail in the vise. Cut half-way through the stile as described in Lesson XIV., letting the sides slope toward the center; then turn the opposite edge of the stile upward and chisel from that side until you have cut through to the center. Pare the sides of the mortise smooth and perpendicular to the surface.

When all the mortises have been cut, fit the tenons in their places. The top and bottom rails cannot be driven home, for they will be stopped by the stud when it reaches the edge of the stile. This brings us to the cutting of the groove for the panels.

## LESSON XXIII.—MAKING A PANELED DOOR—FITTING THE PANELS

You will remember that the planes whose uses we have discussed have in each case an iron narrower than the stock, so that the iron does not cut to the full width of the latter, and it cannot therefore be used to make a right-angled cut on the edge of a board. In order to make a groove between the edges of a board, we must use a plane called the plow. (Figure 112.) The sole and the cutting edge of the plow are of the same width. The plane-iron can be adjusted so that it will take off a shaving of greater or less thickness, as with other planes. On one side the plow is provided with a "fence," which may be set at varying distances from the plane-iron, and this determines the distance of the groove from the

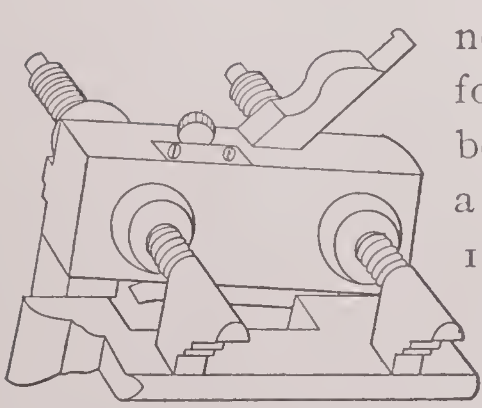


Fig. 112

face of the board. A stop, which may be adjusted, determines the depth of the groove. In use, the fence is pressed against the working face adjacent to that which is to be grooved, and must not be allowed to tip outward or to part from the face, else the groove will be irregular.

In preparing stock for doors, the stiles and rails are generally grooved by machinery, which works with great accuracy. For our purposes, it will be better to do the work by hand, with the plow. Several plane-irons of different widths are made to fit in a single plow. We will select the iron that has a cutting edge $\frac{3}{8}$ inch wide, and adjust the stop and the fence so that the plow will make a groove $\frac{1}{2}$ inch deep, midway of the board.

Try the plow first on a piece of waste board, until you fully understand its use, and then you may groove the stiles and rails. In every case, the fence is to be pressed against the X face of the wood. If you groove one piece with the fence against the X face, and the next piece with the fence against the unmarked face, your panels may not fit into place readily. The stiles and the top and bottom rails are to be grooved on the inner edge only. The middle rail is to be grooved on both edges. When grooving near the mortised ends of the stiles, push the plow carefully, so as not to splinter the edges of the mortise.

When the grooves have been cut to the required depth, the pieces may be jointed, and you will now see how and why the studs on the top and bottom rails must be pared to a width less than that of the tenon, so that they will fit into the groove. Pare the studs and drive the tenons home. See if the grooves meet each other accurately at the corners, and if there are any irregularities in them, take the frame apart and pare the grooves with the chisel, as needed.

Your next work is to fit the panels in their places. Plane to the desired thickness the two pieces which are to serve as panels, and finish them with the smoothing-plane. Plane one of the upright edges of each piece to a straight line, and then make the opposite edge parallel to it. The width of the panel is to be 11 inches. Saw and plane the ends of the panels so as to make them square with the sides. The upper panel will be $13\frac{1}{2}$ inches long and the lower panel will be 11 inches square

To fit the panels to the groove, you will need to chamfer the edges. With the gauge, mark a line lightly all around the panel, 1 inch from the edge. In the same way, mark on the edge of the panel a line to show the depth to which the chamfer is to extend, $\frac{1}{4}$ inch. Plane away the wood from the 1-inch mark on the face to

the $\frac{1}{4}$-inch mark on the edge. In planing the upper and lower edges of the panel, remember to plane across the grain at an angle. Chamfer the other side of the panel in the same way. The panel should now fit into the groove as in Figure 113, the point being $\frac{1}{2}$ inch from the bottom of the groove. It should not fit tightly, nor require to be driven in with the mallet. If it cannot be pushed into place with the hand, it is too tight, and the chamfer should be extended a trifle deeper. What is desired is to have the panel fit easily in place, but without being loose.

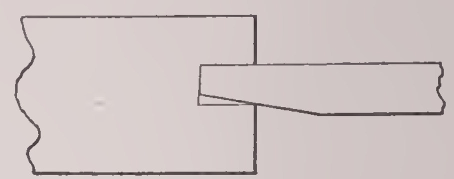


Fig. 113

We have made the frame thicker than it should be, to avoid splitting the stiles while cutting the mortises. Take the frame apart and plane the frame to a thickness of $1\frac{1}{8}$ inch, as you learned to do in Lesson V., being careful to have the mortise exactly in the center of the stile when finished. This planing will remove the pencii marks drawn as a guide in making the mortises.

The edges of stiles and rails are now square, but a proper regard for the ornamental function of the door requires that the inner edges, surrounding the panels, shall have a finish of some sort. This may be obtained by chamfering the edges, or by inserting a narrow molding against the edges and resting on the panels. This is properly a part of finishing the door, which we will consider in another lesson.

## LESSON XXIV.—MAKING A PANELED DOOR FINISHING

The panels of a door are generally finished alike, but as we are striving to learn all we can of methods in woodwork, we will finish the two panels of our door with different treatment. We will chamfer the edges of the frame adjacent to the upper panel, and fix a molding against the edges adjacent to the lower panel.

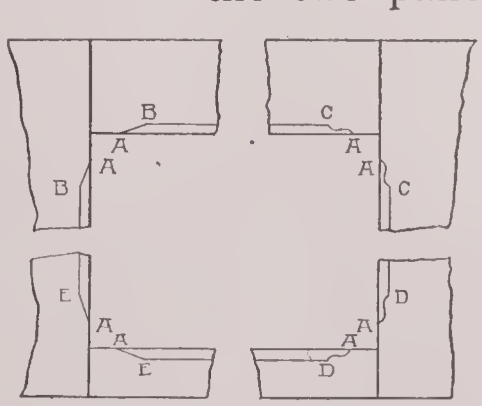


Fig. 114

The chamfering should be done before the frame is fastened together. Select a point, A, Figure 114, on the inner edge of the stile, 1 inch from the corner where the rail meets it. Lay off the same distance from each of the corners, on both rail and stile. Find the points B, C, D, and E, each $\frac{1}{2}$ inch from the edge and 1 inch from A. Set the gauge to $\frac{1}{2}$-inch measure and draw BC, CD. You will now draw AB, AC, etc. With a sharp chisel, score the edge, being careful not to go too far toward BC and CD. When the greater part of the

superfluous wood has been chipped out, chamfer the edge to BC and CD. The bevel at AB may be given a gentle curve, represented by the curved line AC, Figure 114. The chamfer should be at the same angle to the surface of the panel and to the surface of the stiles and rails. To make this chamfer clean and smooth will test your skill with the chisel, and you will find it difficult to avoid leaving a very slight ridge, now and then, where successive strokes of the chisel were not quite in the same plane. A piece of very fine sandpaper, stretched over a block, may be used to finish the chamfer, in the manner described in Lesson XIX.

We have decided to finish the lower panel with a border of molding, but this cannot be applied until the door has been jointed. First, however, set the smoothing-plane so it will take off only a hair-like shaving, and pass it once only along the inner edges of the stiles and the rails, and over the surface of the panels.

The next step is to glue the tenons and mortises together, at the same time adjusting the panels in the grooves. First fix the three rails against one of the stiles; then slip the panels into place, and adjust the remaining stile. No glue should be put on the shoulders of the tenon, as it would be pressed out and daub the surface of the door when the frame is put in pressure. Do not glue the panels, but leave them free to move back and forth when they shrink and expand. If they are glued into the grooves, the glue may prove stronger than the wood and cause the panels to split, when they shrink. Before the glue sets, try the frame at the corners, with the square, and if necessary, true it with light strokes of the hammer, delivered on a block of wood held at the proper corner. In gluing the box together you used handscrews to hold the pieces tightly together until the glue had dried, but you have no handscrews large enough to receive the width of the door between their jaws. You must, therefore, improvise a handscrew. Take two stout boards, longer than the width of the door, and nail across them two strips as thick as the door. The first two pieces should be separated so that the distance between their inner edges will be less than the distance between the inner edges of the top and bottom rails, *viz.*, 25 inches. The crosspieces should be far enough apart to allow the door to lie between them, with two inches to spare on either side. Now shape four wedges, and place them in pairs between the door and the crosspieces, a little farther in than the edges of the rails, as in Figure 115. These preparations must be made before you glue the

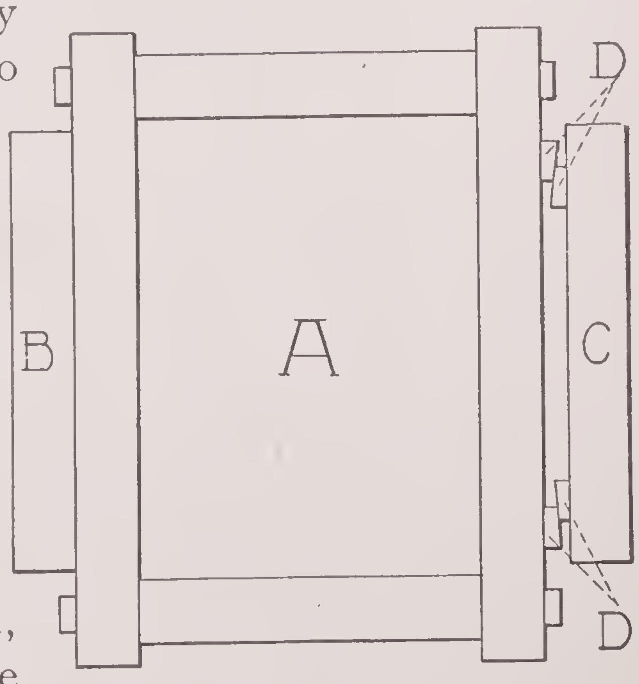


Fig. 115

frame together. When the gluing has been completed, lay the door between the crosspieces and drive the wedges against each other. This will press the stiles firmly against the shoulders formed by the tenons of the rails. The result is the same as in using the handscrew. When the glue has become thoroughly dry, the wedges may be knocked out of place and the door released.

You may now fit a small molding against the inner edge of the frame, around the lower panel. A very simple molding, or "bead," will serve. Measure carefully and get out four pieces, each 10 inches long. Miter the corners so that the highest surface of the molding is outward. Use your fine brad-awl to pierce three holes in each strip of molding. Unless you do this carefully, the molding will split. With small wire brads, nail the four pieces to the inner edges of the stiles and rails, not to the panels. The nails should be driven in an oblique direction, and set a little below the surface of the molding. Your nail-set will be too large for this work, and in its place you may use a small brad, striking on the edge of the head, which you will hold against the nail you have driven. The upper edge of the molding, when in place, should be a little lower than the surface of the frame.

You can now cut off the projecting ends of the stiles and the tenons with the back-saw, taking pains not to let the saw gash the frame. With the smoothing-plane, give a last light finish to the faces and the edges of the frame, and from the corners take off a hair-like shaving all the way around. This shaving should be so fine that the door will appear to have sharp edges, except on very close examination.

The door may now be lightly dressed with fine sandpaper and then given a coat of shellac varnish. These two processes have already been employed in finishing the box, in Lesson XIX.

## LESSON XXV.—CARE OF TOOLS

In the foregoing lessons, frequent allusion has been made to the necessity of having sharp tools for certain work. It is assumed that all cutting-tools will be kept well sharpened, and these allusions have been made merely to emphasize the importance of keeping tools in a proper condition at all times. Good work cannot be produced with dull-cutting edges, and in general, no tool which is carelessly treated can be expected to be as efficient as one that is kept always in the best condition.

In the first place, every tool should have a place and be kept in that place, when it is not needed on the bench for the work in hand.

Nearly all the tools used by the woodworker have parts made of steel or iron, both of which are likely to rust. They should, therefore, be protected from moisture, by keeping them in a dry place, and should now and then be rubbed with a drop of oil, applied with a cloth. Do not put on too much oil — the merest film is amply sufficient to keep moisture from the surface of the metal.

Edged tools should not lie one above the other, nor should the cutting edges be allowed to come in contact with substances upon which they are not to be used. You cannot expect your chisels to remain in good order, if they are thrown carelessly upon the bench or dumped promiscuously in a box. They should be placed in a rack, where they can be supported at the shoulder between the blade and the handle, with the cutting edge pointing downward and the flat side outward.

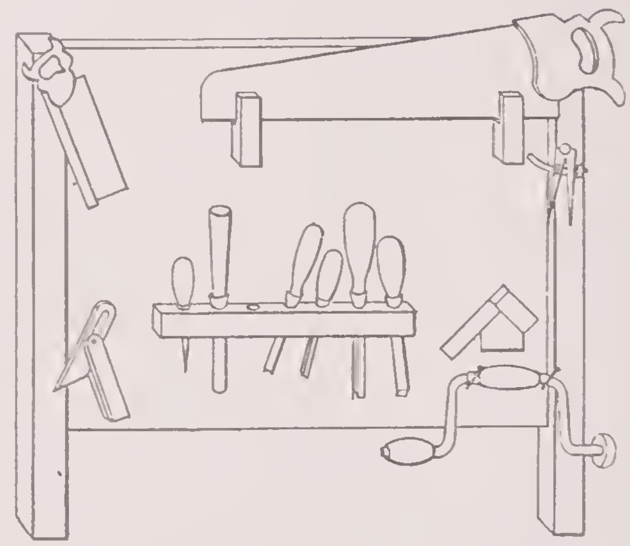


Fig. 116

Planes should not rest on the edge of the plane-iron, which projects a little beyond the sole. A small stick should be placed under the toe of the plane, so that the iron will be raised above the bench.

Saws should be kept in a rack consisting of two upright boards in which kerfs have been made, so that the blade may be placed in them, toothed edge upward.

A set of bits is often kept in a small box, but there is much less danger of injuring their cutting edges, if they are placed in a rack, made of a strip of wood in which holes have been bored, a little larger than the shank of the bits, but not large enough to permit the auger-end to slip through.

The drawknife should be supported on two pegs, separated nearly to the width between the handles.

Whenever you sharpen tools on the oilstone, remember to replace the cover of the box, after using it.

Materials, such as nails, screws, glue, etc., should be kept in covered boxes. After you have had as much experience as should be obtained from the foregoing lessons, you can make a small case of drawers, in which nails, screws, brads, etc., may be kept.

When you have finished work, for the time being, put away all tools in their places, brush the bench-top free from chips and dust, and cover it with a cloth. This takes but a moment and prevents dust from settling on the bench-top and the tools racked at the back of the bench.

It is desirable to have a substantial tool-box, large enough to hold planes, saws, chisels, and other tools, without crowding, and when you feel qualified to do so, you should make such a box for

yourself. When the tools are not in use, keep the box locked and the key in your pocket. If other members of the family need to have small jobs done, they should apply to you, as the one who is supposed to know best how to use tools, instead of borrowing your tools for their own use, when you are absent.

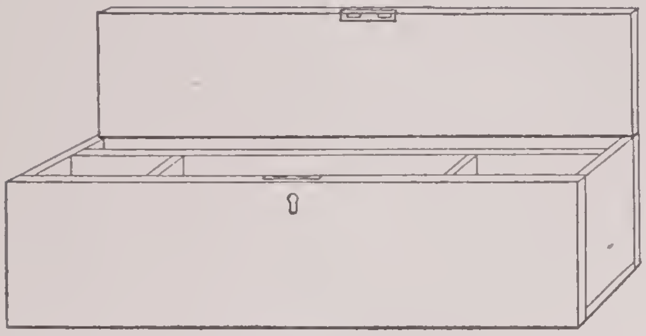


Fig. 117

Although they may have the best of care, tools become dull from legitimate use and must be sharpened. It is sometimes necessary to sharpen a chisel several times before you have finished using it on a single piece of work. One of the most important features of the woodworker's craft is, therefore, the sharpening of edged tools. For this work, a high degree of skill is required, as a good tool may be easily spoiled by unskilful sharpening. The pupil should, however, learn to sharpen his own tools, and as it is almost impossible to impart the knack of sharpening by means of printed instructions, it is urged that lessons in sharpening should be had under a competent instructor. The course of lessons outlined in this book is designed especially to aid those who are not within reach of regular Manual Training schools, but in every community there are carpenters and mechanics whose occupation obliges them to understand the sharpening of tools. They are not considered the most competent teachers of Manual Training, which, it must be remembered, is not carpentry, but they can at least give object-lessons in the sharpening of tools and the young woodworker should learn, by observation, how to use the saw-set, the grindstone, and the oilstone.

For the guidance of beginners when they undertake to sharpen their tools, certain rules are to be borne in mind. Take, first, the saw. You have already learned that the teeth of rip and crosscut-saws are "set" and filed differently, and that the amount of "set" determines the width of the saw-kerf. A saw which is to be sharpened is fixed, toothed edge upward, in a saw-clamp, which, in turn, is held in the vise. The saw-clamp consists of two pieces of hard wood which are joined by two screws, as in Figure 118. When the saw-blade is placed between the jaws of the clamp, the screws are tightened so that the saw cannot slip.

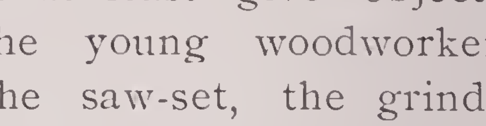


Fig. 118

The saw is first "jointed"; that is, a file is passed along the ends of the teeth, so as to make the teeth all of the same height. The saw-set, which is a notched steel blade set in a handle, is then applied to the first tooth, beginning at the handle, and the tooth is bent outward. The third, fifth, seventh, and remaining alternate teeth are then

bent in the same direction. The second, fourth, sixth, and remaining alternate teeth are then bent to an equal angle, in the opposite direction. Another form of saw-set consists of a hammer, hinged at the back, which is made to strike the tooth while the blade of the saw is held against a plane surface at the correct angle. The setting of a saw must be done with great accuracy. The teeth must not be bent too sharply, lest they break. Nor should they be turned aside too far, the general rule being that the width of the kerf shall never be more than double the thickness of the teeth. The teeth are bent much or little according to the kind of work on which the saw is to be used. The teeth of a back-saw, which is used to make fine cuts, are not bent so much as those of a coarser saw, used for rough work. Saws intended to be used chiefly on pine and other soft woods have a wider "set" than those used on hard woods. The sharpening of the teeth is done with a triangular file, of such shape as to admit of its passage between the teeth to the bottom of the notch formed by their sides.

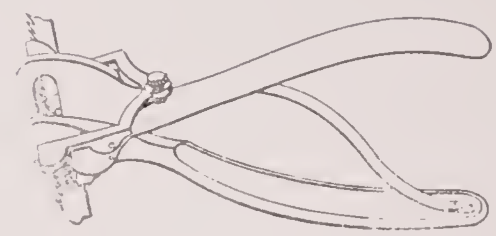


Fig. 119

In filing a rip-saw, the file is held perpendicular to the face of the blade. It is drawn at right angles to the blade, one side of the file resting lightly against the tooth A, Figure 120, while the real cutting is done at the tooth B. You will see by this that the sharpening is done toward the point of the teeth, and not away from it. As the filing leaves a slightly turned edge on the farther side of the tooth, the teeth are not filed one after the other, but the first, third, fifth, and so on, are filed toward C, until the end of the saw is reached, and the alternate teeth are then filed in the opposite direction, toward D.

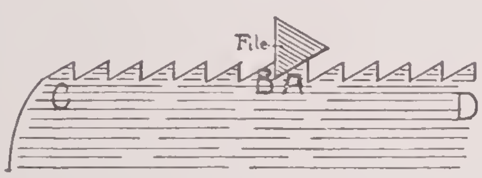



Fig. 120

In filing a crosscut-saw, the file is held at an angle to the edge, according to the character of the tooth desired, as in Figure 121, and the teeth are filed in alternation, as already described. An angle is formed on both inner edges of the tooth, in a crosscut-saw.

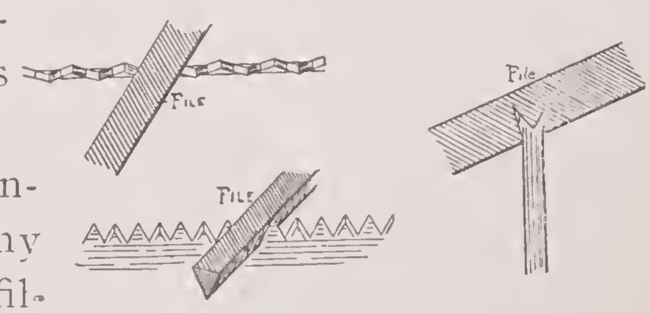



Fig. 121

The jointing of the saw, which has been mentioned as the first step in sharpening, leaves a tiny face on the points of the teeth. The subsequent filing, or actual sharpening, must continue until this face has disappeared, which shows that the tooth has been brought to a keen edge.

To remove the edge formed on the outside of the teeth by the filing already described, the saw is "jointed" on both sides, by passing the file lightly along the teeth. An oilstone is sometimes used

for this purpose. The file must always be drawn forward with long and steady, not jerky, strokes, and it must not be given a rocking motion.

The teeth should be only a little way above the clamp-jaws while the saw is being filed, in order that the teeth may not vibrate; and the screws should occasionally be examined to make sure that they have not slipped, so that the saw may not drop from the proper position.

While Manual Training does not look first to economy, but rather to giving the necessary educational training, there would be no educational value in spoiling a good saw because the unskilled beginner desired to set and sharpen it without having seen the work properly performed by a competent person.

The same argument applies to the use of the grindstone and oilstone, on which edged tools are sharpened. The use of these two implements is not so difficult to learn, however, and from the rules given in this article the beginner may learn to grind chisels and plane-irons properly. In actual experience, more rapid progress is made if this work is performed under the direction of a teacher or some competent workman.

The grindstone is a slab of sandstone, circular in form and made to revolve on an axle, which is turned by means of a handle or a treadle. For the beginner who expects to do most of his work by himself, the treadle will be a necessity.

To attempt to grind a tool on a dry stone will ruin the tool, as the heat generated by the friction will burn the steel and make it soft. To avoid this, a tank for holding water is elevated above the center of the grindstone at one end of the tank, and from a small tap the water is allowed to trickle upon the stone while the latter is in use.

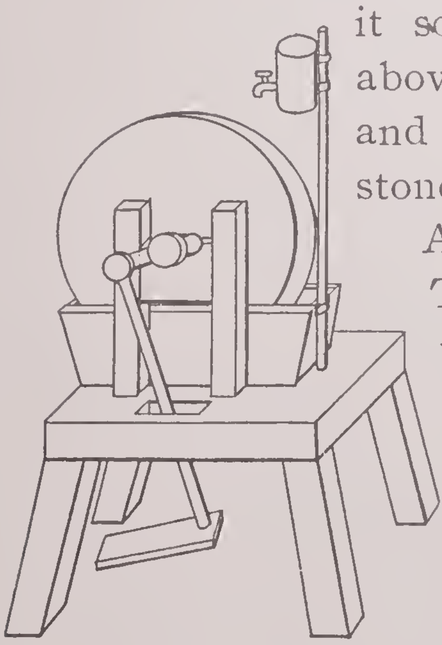


Fig. 122

A trough is fixed below the stone to catch the waste water. This water should be drawn off when the stone is not in use, as water softens the stone and makes the part that remains long immersed wear away faster than the remainder of the stone. The stone should therefore be kept dry when it is not in use. The water absorbs the heat caused by friction and at the same time carries away the fine grit loosened from the surface of the stone, leaving the cutting surface clean and effective. The grindstone should be provided with guards fixed to the frame, to keep the water from the clothing of the operator.

In grinding, keep the stone turning toward the tool, with a steady, continuous motion. Always apply the tool to the stone after

the latter has been set in motion. Never revolve the stone away from the tool, as that will turn up the edge of the tool as in Figure 124, and spoil it.

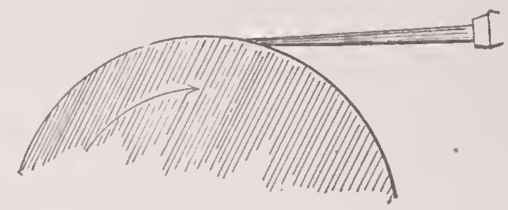


Fig. 123

To grind a chisel, the bevel should be applied to the stone at an angle of 25 degrees. As it is not easy for a beginner to hold the tool continuously at the proper angle, a support should be fixed to the frame, so that the blade of the chisel may be passed through a mortise, Figure 125. This support should be adjustable, so that different tools may be held at different angles, as required.

Fig. 124

While grinding, the tool should be moved from side to side, and not allowed to rest wholly on the middle part of the stone, nor on one side, as this wears away the stone in one place more than in another, and produces an uneven surface. When the bevel of the chisel has been reduced to an angle of 25 degrees, it is theoretically ready for use, but it will be found that the grindstone leaves a feather-like edge on the tool. To make this edge straight and keen, the chisel must be rubbed on an oilstone.

A piece of this stone, about two by five inches, is set in a block of wood, and a cover is provided to fit over the stone when the latter is not in use. Sperm-oil or olive-oil is used on the oilstone to absorb the heat generated by friction, just as water is used for the same purpose on the grindstone. So far as possible, the entire face of the oilstone should be brought into use, in order that it may not be hollowed by rubbing only in the center or beveled by rubbing only at one side.

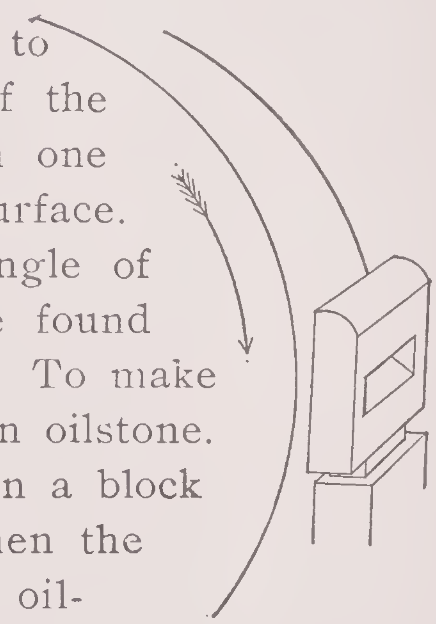


Fig. 125

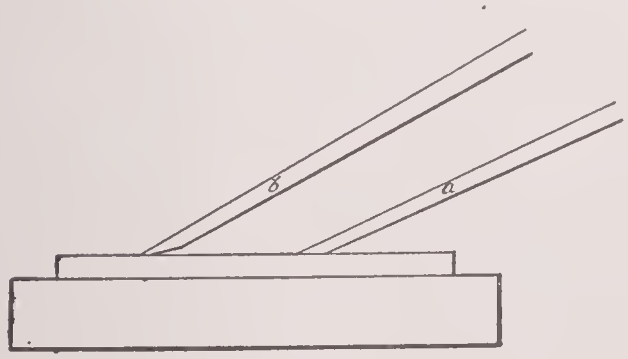



Fig. 126

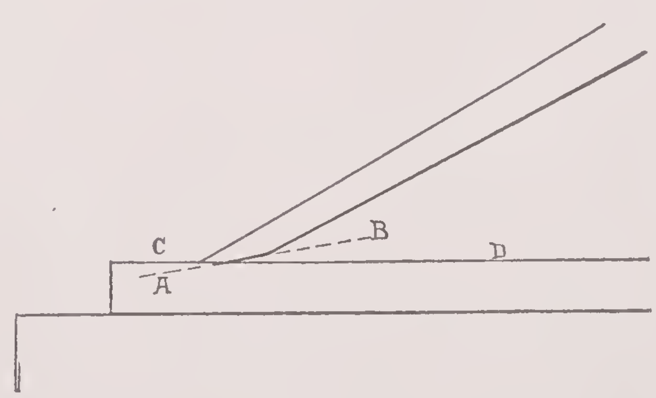



Fig. 127

The chisel, having been ground on the grindstone, is applied to the oilstone, as shown in Figure 126. The edge is pushed away from the operator, not drawn toward him. After the bevel produced by the grindstone has been rubbed a little, the handle of the tool is raised at an angle of 35 degrees, so that the edge is now given a different bevel. In Figure 127, AB shows in an exaggerated outline, the bevel produced by the grindstone, and CD shows that produced by the oilstone. In rubbing the tool, the hand must not move

up and down as that would produce a rounded edge, as in Figure 128. The hand must move back and forth, parallel to the stone.

Fig. 128

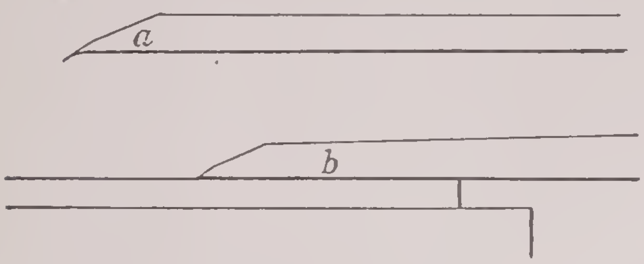



Fig. 129

When the bevel has been rubbed to a keen edge, the steel will tend to turn up a little, producing a wire edge, which is shown, in an exaggerated form, in Figure 129, *a*. This must be removed by rubbing the tool on the stone two or three times with the flat side close to the stone throughout, as in *b*. Be careful not to raise the handle while doing this lest you produce a rounded edge.

A chisel properly sharpened will have an invisible edge. As you sight along the edge of the tool it should be impossible to distinguish exactly where the edge is. If the edge is made plain by a shining line, it shows that the edge is rounded and it must be rubbed down.

When you use a chisel frequently, in the course of an exercise, as in cutting mortises for the door-frame, in Lesson XXII., this invisible edge, by constant use, will become dull, and you will need to improve its cutting quality by rubbing it often, a little at a time, on the oilstone. These frequent rubbings on the oilstone will in time widen the short bevel near the edge so much that the chisel will again require grinding on the grindstone.

"Slips" of oilstone are pieces of oilstone, rounded or wedge-shaped, which may be held in the hand and used for sharpening such tools as the drawknife or the gouge, which cannot easily be applied to the blocked oilstone. They are very convenient, but a steady hand and a true eye are needed to make them effective and prevent harm to the edge of a tool by a rocking or irregular motion, while sharpening.

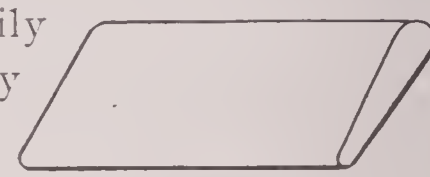


Fig. 130

A plane-iron is ground in the same way as a chisel, care being taken to hold it at a proper angle. It is given a final beveling on the oilstone. In effect, the chisel and the plane-iron are identical tools, although they are provided with different handles or supports and are used in different ways.

It is not so easy to grind a knife properly as it is to grind a chisel, for the reason that the knife-blade is narrow and cannot so readily be held in proper position on the stone. The blade is thin and the angle must be less than that at which the chisel or plane is ground. You will find it best to rest only a small portion of the blade on the stone at a time; but the blade should be kept moving back and forth across the stone. When the point is to be ground, the handle should be swung to and fro from the operator, in order that

the entire edge may be ground. When the final sharpening is done on the oilstone, the knife is rubbed along the line of an O. As the blade is thicker near the handle than it is toward the point, it will be necessary to raise the handle slightly, now and then, in order to bring the point in contact with the stone. As the oil-stoning may leave a very thin, feather-like edge, the knife should be passed a few times over a strap of leather, as you would strap a razor. This removes the thin, brittle edge. Both sides of a knife, or of a hatchet, which is ground in like manner, should receive like treatment.

In spite of all the care that may be taken to bring the entire face of the grindstone into use, it will become more or less grooved and ridged. It will then be unfit to grind the broad edge of a plane-iron, for example, and must be trued. There are mechanical devices which may be applied to a grindstone to scrape the face, one of which consists of a cylinder having a screw-thread on its face. The cylinder revolves against the stone and shears away the ridges. Another method is to revolve the stone against the end of a flat piece of iron until the face is perfectly true.

Another treatment which the grindstone requires is the occasional removal from the face of the fine particles of steel, released from tools which have been ground, and the fine grit, which accumulates in the nicks of the stone until its face becomes smooth and fails to cut. The water dropped on the stone prevents this accumulation, to some extent, but not wholly. When the stone has become clogged so that it fails to cut, it must be scraped. For this purpose, it is revolved against a bar of soft iron, held across the face, which soon removes the accumulated grit and renews the cutting-face of the stone.

An oilstone, after long usage, may, like the grindstone, require to be "trued." To do this, the stone is placed face down on a sheet of sandpaper, and rubbed against the sandpaper with a circular motion until it is seen to be true, when tested with the blade of a square or other straight-edge. If the stone is badly grooved, it may be more quickly ground by rubbing it on a plane surface of iron, on which a little emery has been placed. A few drops of oil should be added to the emery.

The sharpening of bits is done with a file, which is applied only to the inner edge of the nib. If the outer edge were to be filed, the diameter of the hole made by the bit would be lessened. The cutting lip at the bottom is filed from the lower side and the spur may be kept in order by filing it with a triangular file. The sharpening of a bit is a delicate operation, and ought not to be undertaken by unskilled hands.

It is suggested that a cheap iron chisel may be ground and sharpened before the same work is attempted on more expensive tools. The use of cheap tools in woodwork practice is not recommended, however, as they soon become dull and fail to give satisfactory results.

## LESSON XXVI.—ADDITIONAL TOOLS

The assortment of tools enumerated in the introduction to these lessons will be found amply sufficient for such practice work as should be undertaken by the young woodworker during the first nine months of his Manual Training course.

If, however, he desires to increase the scope of his work during the second year, additional tools may be supplied. They should not be purchased unless a definite need for them arises during the progress of work which cannot be satisfactorily turned out without adding to the original kit of tools. To have too many tools is as undesirable as to have too few. Parents and guardians must take into consideration, when urged to supply new tools, the progress made by the boy in using those which he already has. Granting that he has developed skill, accuracy, and inventiveness in using the simpler tools, his desire to possess and use new ones should not be hastily discouraged.

Additions may be made to the supply of chisels and gouges. In making mortises, particularly, the young woodworker often finds that if would be convenient to have a chisel a little narrower or a little wider than any in his kit. A compass-saw is extremely useful for sawing along curved lines, and for quickly getting out the superfluous wood from mortises, after holes have been bored with the bit. A crosscut-saw, set and filed especially for sawing hard, fine-grained woods, is a convenient addition to the tool-chest. A frame-saw, or jig-saw, with an assortment of narrow, thin blades, is useful for getting out such work as the inner scrolls of a bracket, where the compass-saw which is intended for coarser work, would not be effective. A small, light back-saw, called a dove-tail saw, makes it easy to cut dove-tails with more accuracy than when a larger and heavier back-saw is employed for that purpose.

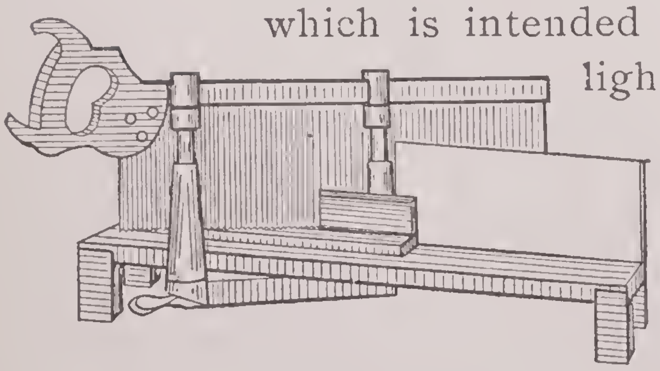


Fig. 131

An iron miter-box (Fig. 131) is a convenient accessory. It has a pair of adjustable guides through which the saw is pushed, and which may be quickly set at any desired angle. As the box is open in front, the wood to be cut away may be held in place more easily than in a wooden miter-box. Many styles of planes are made. A beading-plane is useful in forming a bead on the edge of a board, as, for

example, the inner edge of door-stiles and rails, where it gives a neat finish to the panel. (Fig. 132.) A rabbeting-plane is for planing close to an adjacent surface, as in Figure 133. A circular-plane has an adjustable sole, made of thin steel, which may be drawn to a curve, upward or downward, as in Figure 134. It will readily be seen that this is a most useful tool for planing concave or convex surfaces. In the foregoing lessons, it has been shown that the smoothing-plane may be used for planing end surfaces, but it is too large and cumbersome to be convenient for such use on small work. A small iron block-plane should, therefore, be provided.

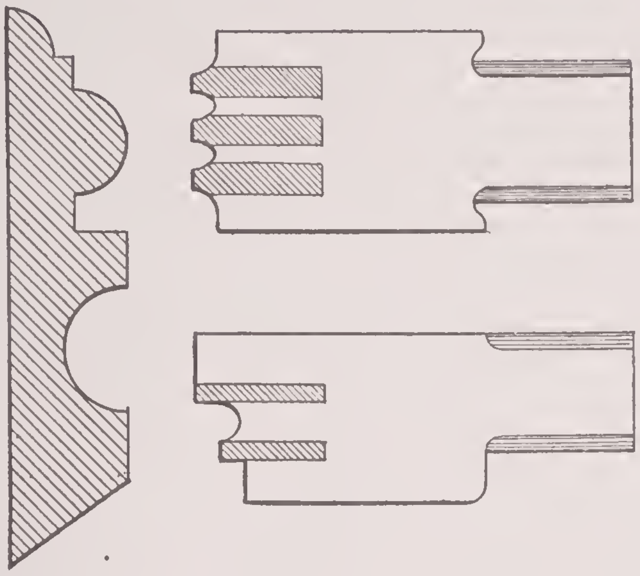


Fig. 132

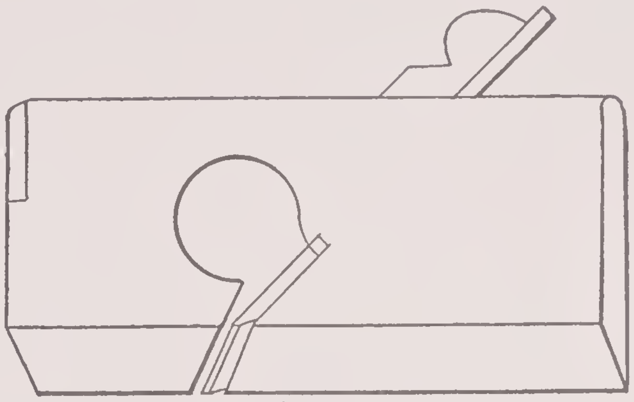


Fig. 133

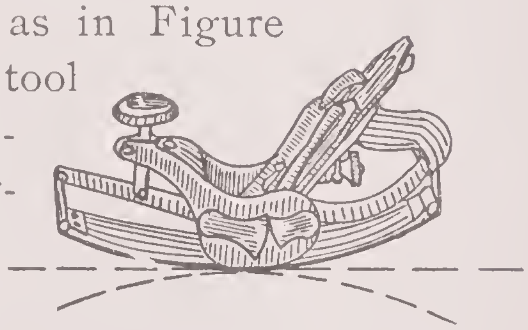


Fig. 134

The spokeshave, which was described in Lesson XII., is not an expensive tool, and is often used in smoothing rounded surfaces.

One of the most convenient of modern tools is the automatic boring tool, which takes the place of the brad-awl. Without entering into an extensive description of this tool, it may be said that it consists of a handle and a set of points, or drills, which are interchangeable, as in the case of the bits accompanying the brace. These points make holes from $\frac{1}{8}$ inch in diameter down to a hole suitable for the smallest brad. The point is placed in contact with the wood, and a straightforward pressure on the handle causes the drill-point to revolve at great speed. This not only bores the hole quickly but lessens the danger of splitting the wood, if it is very thin and narrow. When the pressure is removed from the handle, the drill, actuated by a spring, revolves in the opposite direction and may thus be quickly withdrawn from the hole. A similar tool is made for the quick driving of screws. (See Fig. 135.)

Fig. 135

Pincers, pliers, and a wire-cutter are not indispensable tools, but they are very convenient, and are not expensive. In each case, the tool consists of two steel or iron blades which move on a pivot near the jaws, the remainder of the blades being shaped as handles. Or-

dinary pincers have broad, curved jaws, and are used for withdrawing nails. In confined situations, where a claw-hammer cannot be used, they are exceedingly useful. The wire-cutter has nearly the same shape as the pincers, but the jaws are sharpened, so that it will cut off a nail or a wire, and this cutting may be done close to the wood in which the nail is driven. For quickly cutting a wire, especially one of soft metal, they offer so great an improvement over bending or filing as to be almost indispensable. Flat pliers have jaws whose inner surfaces are file-cut and meet in the same plane. Small pieces of metal may be firmly held in these jaws, for bending, etc. Round pliers have cone-shaped jaws, and are used in bending metal on a curve. (See Fig. 136.)

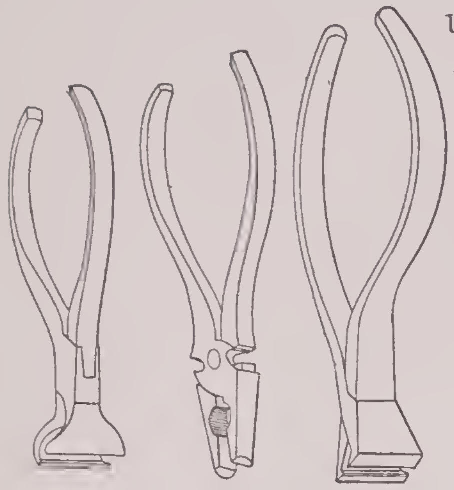


Fig. 136

The only form of file to which allusion has been made in the foregoing lessons is the triangular file, which is used for filing saws. There are, however, several forms of files which are useful in wood-work. A long, broad rasp will often be found useful in reducing rough edges, before the plane is applied. A flat file is a convenient tool for smoothing the sides and corners of mortises. The round file and the convex side of the half-round file are useful in smoothing concave surfaces, shaping the outline of keyholes, scrolls, etc. In use, the handle of the file should be grasped in one hand while the fingers of the other hand are pressed on the upper surface of the farther end. For straight work, it is necessary to avoid a rocking motion of the file, which should move forward in one plane. (See Fig. 137.)

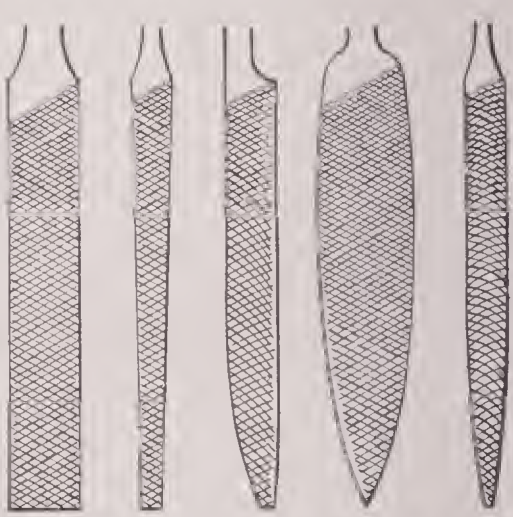


Fig. 137

The use of the dividers, the gauge, and the square and pencil have had frequent exemplification while the making of the box and the door were in progress.

Nothing has heretofore been said about the use of the chalk-line. This is useful on large work, where a long, straight line is desired as a guide for sawing or planing, and cannot be easily and accurately drawn with the ruler, as, for example, in marking a board to be divided with the rip-saw. (Fig. 138.) The chalk-line is a small, finely-woven cord, generally wound upon a wooden spool, whose end-discs are large enough to raise the cord above any surface on which the spool rests. The two points between which the line is to be drawn are marked on-

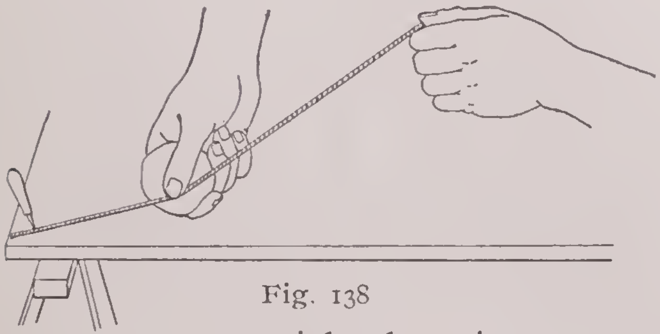


Fig. 138

the board. The point of an awl is then passed through a loop at the free end of the line and the awl is fixed upright in the wood at one of the points. Unwind a length of cord sufficient to extend beyond the other point. Holding the cord taut, and above the board, rub the chalk upon the cord, beginning close to the awl, and letting the cord bend about the curved surface of the chalk. When the cord has been well chalked, draw the line taut on the board and hold it, with

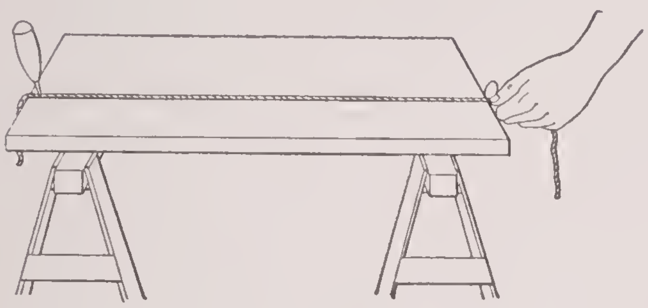


Fig. 139

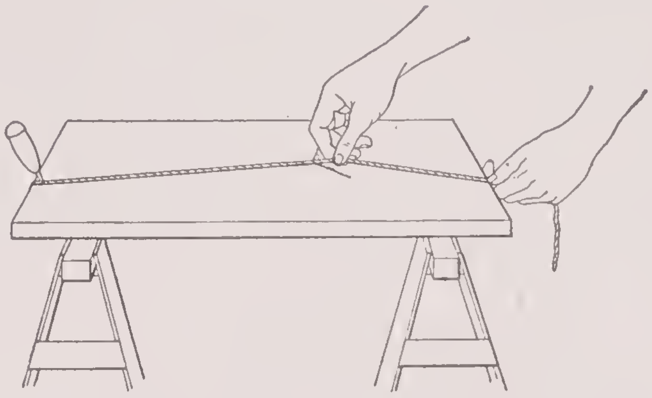


Fig. 140

the thumb, at the point on the end opposite from the awl. (Fig. 139.) Holding the line taut, with the thumb of one hand, draw it upward with the thumb and forefinger of the other hand, and sight along the cord to make sure that it is vertical throughout its length to the line between the two points. Let go the cord and it will snap sharply on the board, leaving a distinct chalk-line between the two points. (Fig. 140.) Wind the cord on the spool again, lifting it above the board so that it will not rub or widen the line just made, and put it away. On nearly all kinds of wood in common use, blue chalk makes a more distinct line than white, and is therefore recommended.

## LESSON XXVII.—FASTENINGS

Nails, screws, brads, and glue have been used in putting together the box and the door, but only one kind of each has been employed, and it is well to be familiar with the different forms of these materials. Nails are divided into several classes, according to the material of which they are composed, the method of making them, and the purpose to which they are to be applied. Iron and steel are the materials commonly used in making nails. Cut nails are stamped from a sheet of metal. This is done by machinery and the nails are shaped very rapidly. Iron-wrought nails were originally made by hand, but are now produced by machinery. They are soft enough so that the ends can be bent for clinching, without breaking the nail.

Wire nails are made from drawn wire. Some are finished by merely giving them a head and a point; others have the shank

roughened something like a broken screw-thread, so that it will be more difficult to withdraw the nail from the wood. Wire nails cling to the wood with great tenacity, and are not so easily loosened or withdrawn as iron cut or wrought nails, which are wedge-shaped.

Nails are said to be "four penny," "six penny," etc., according to their size, the term having originally come from the fact that a thousand nails of a certain size weighed six pounds, etc. "Pounds" was corrupted to "penny" and the term has survived in that form. An ordinary three-penny nail is 1 inch long; a twenty-penny nail is $3\frac{1}{2}$ inches long. Brads are small nails, with small heads, used for finishing work, where the nail is generally driven in so that the head leaves but a small indentation, which may be filled with putty and painted over.

The heads and points of nails vary according to the uses to be made of them. Some have sharp and some have blunt points, some have broad heads and others have heads only a trifle larger than the

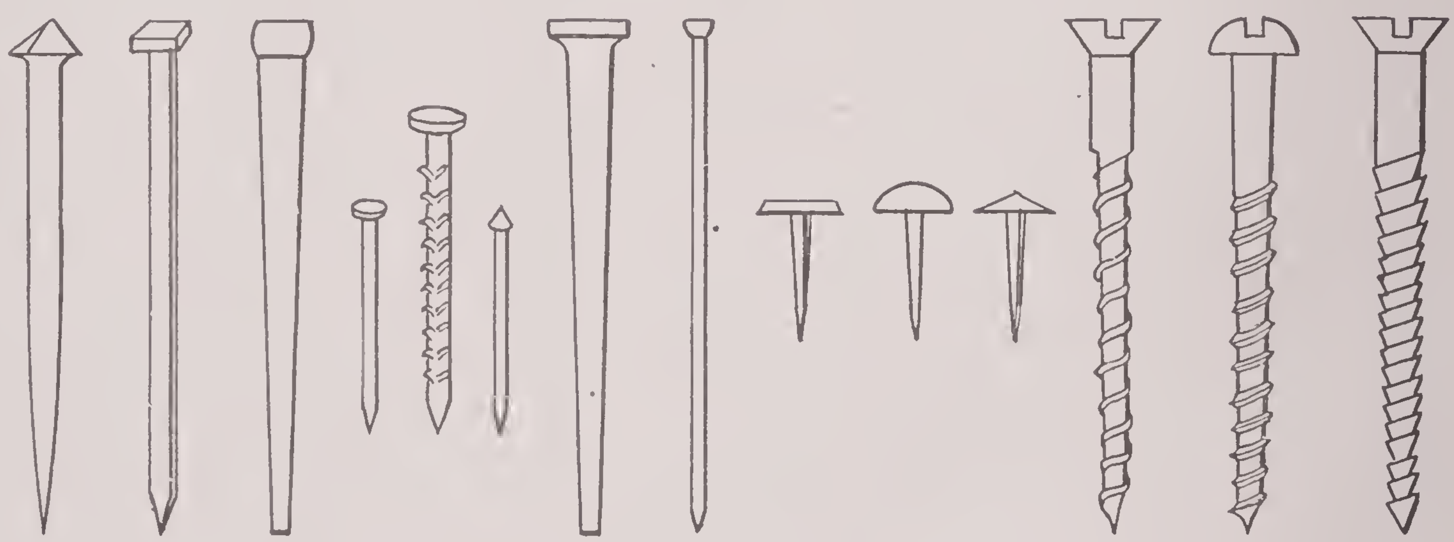


Fig. 141

shank. It will be apparent that those with large heads are intended to be used for coarse work, while those with sharp points and narrow heads are intended for more careful work in finishing. (Fig. 141.)

Tacks are very short nails with sharp points and large heads. They are not intended for joining pieces of wood, but are used for fastening cloth or leather to wood. They are described as one-ounce, four-ounce, etc., that is, 1,000 tacks $\frac{3}{16}$ inch long weigh one ounce, etc.

Screws are made in a great variety of forms and sizes. They are made of steel or brass, and are described as bright or blued. Bright steel screws are polished. Blued steel screws are given their blue finish by treatment in acid, which removes the luster of the bright screw. Blued screws do not rust as readily as do bright screws, and when made with half-round heads, they contribute to the ornamental finish of many kinds of work. Brass screws do not rust, and

these are also used for ornamental purposes, those with half-round heads being preferred. Screws are graded in sizes from 0 to 30, the No. 0 screw being less than $\frac{1}{16}$ inch in diameter, while No. 30 has a diameter of almost $\frac{1}{2}$ inch. The length is also expressed in fractions of an inch.

One advantage derived from the use of screws in joining pieces of wood is that the screws may be easily removed and the pieces separated, if desired, without marring the wood. Small screws are especially useful in fastening metal to wood, as in the case of hinges. In general, their tenacity is greater than that of nails, and they may be driven with less danger of splitting the wood, because the thread of the screw cuts across the fibers instead of merely wedging them apart.

Wooden pegs are used for holding pieces of wood together, as already described in Lesson XIV.

The principle of the wedge is frequently used in forming tight joints. For example, when the mortise does not extend through the piece of wood, the sides of the mortise are sloped toward the blind end, as in a dovetail. One or two saw cuts are then made in the end of the tenon, parallel to the sides of the mortise. Wedges are entered in the saw-kerf and the tenon is then driven home. As it goes farther into the mortise, the wedges are pushed farther into the saw-kerf and cause the end of the tenon to spread and press closely against the sloping sides of the mortise. The open end of the mortise is narrower than the expanded tenon, hence the latter, when driven, cannot be withdrawn. (Fig. 142.)

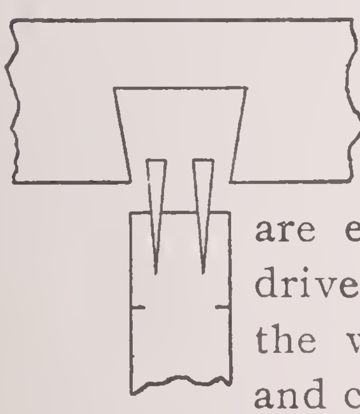
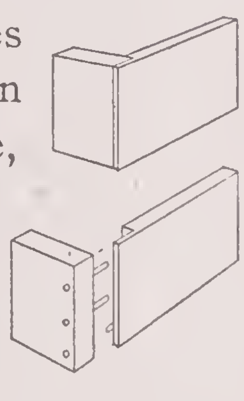


Fig. 142



Dowels are round pins, made of wood, which are used for making blind fastenings, as, for example, in joining the rail of a stair-case to the newel-post, or in strengthening mitered corners, which are comparatively weak joints except when reënforced by some such method as doweling. Holes are bored in the two pieces of wood to be joined, and pegs dipped in glue are then driven into the holes of one piece, or alternately in the holes of both pieces. The projecting ends are then given a coat of glue and driven into the holes in the other piece. If the pegs are made to fit tightly, this forms a strong point. Figure 143 shows the method of using dowels.

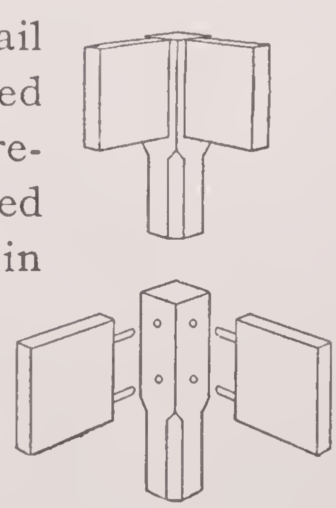


Fig. 143

In the foregoing lessons, the learner has been shown how to make a mortise-and-tenon joint, a mitered joint, and an end dovetail, the simplest form having been used in each case. There are several other kinds of joints which are used by the wood-worker to give

strength in construction, and some of these are briefly explained at this time, with the suggestion that the learner devote a reasonable amount of time to actual practice in making examples of them.

A halved joint is shown in Figure 144. This may be made with the back-saw alone. Figure 145 shows a halved joint in which the chisel must be used for paring the mortise. A halved splice is illustrated in Figure 146. This is used in jointing two pieces of wood so

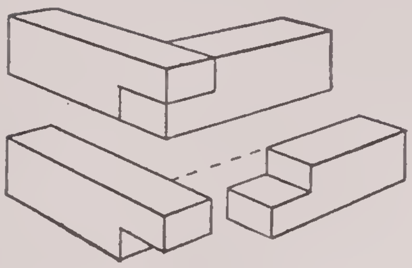


Fig. 144

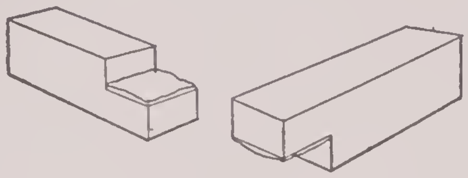


Fig. 145

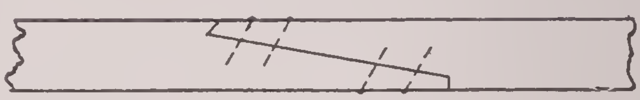


Fig. 146

that in their length way they will follow the same direction. When the two pieces have been cut and fitted together, they may be glued and further secured with nails driven obliquely from one piece into the other, as shown by the dotted lines. Another form of halved joint is shown in Figure 147. This is used when two pieces of wood are to be crossed, as in making the divisions of type-cases, etc.

A mitered corner may be greatly strengthened by a mortise-and-tenon joint; either open, as in Figure 148, or blinded, as in Figure 149.

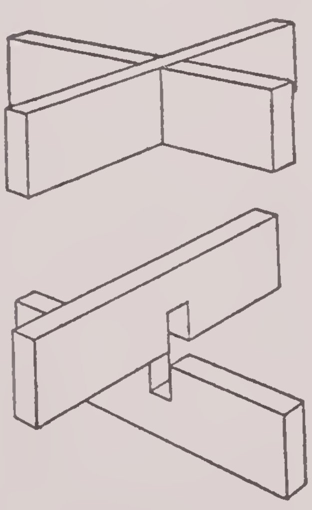


Fig. 147

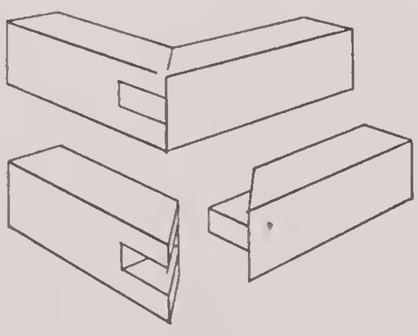


Fig. 148

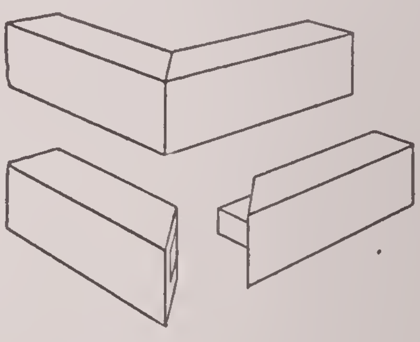


Fig. 149

The strength of a halved joint may be increased by dovetailing. Figure 150 shows a half-dovetail joint, halved together. An ordinary dovetail joint, with five tongues, was used in putting the box together in Lesson XVII. In making a second box, you may make a half-blind dovetail joint, as in Figure 151, a blind dovetail joint, as in Figure 152, or a mitered corner, dovetailed, as in Figure 153.

When the thickness of the wood permits of so doing, open mortise-and-tenon joints are sometimes made double, as in Figure 154, to which mitering may be added, as in Figure 155.

No rules for measuring, or for the use of the saw and chisel, in making these joints, are given here, because the principles involved have already been learned from the foregoing lessons.

The principal thing for the parent to keep in mind is that the boy should do real work. This work, of course, should be within his reach, but, when it is within his reach, insist that he do it. Let him make his own playthings. If he wants a sled, he should make it for

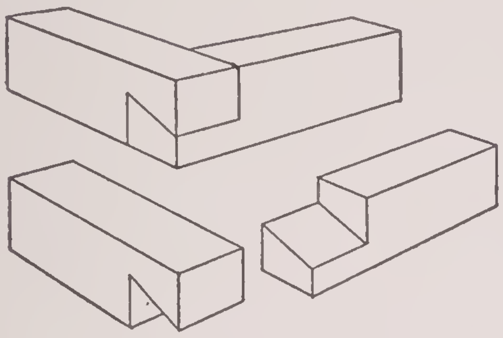


Fig. 150

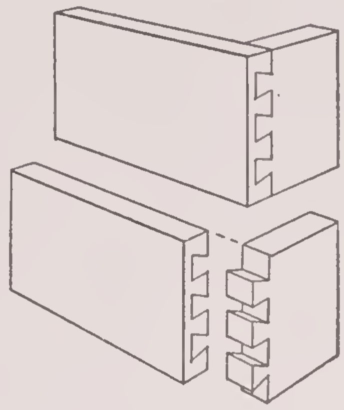


Fig. 151

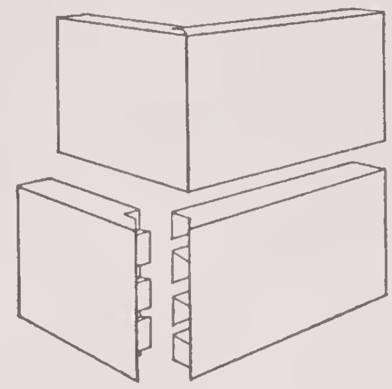


Fig. 152

himself. It is a wrong to the boy, an injury to his real growth and education, to buy for him a sled which he might have made for himself. The home-made sled has an individuality which a sled from the store cannot possibly have, and if it is well made it has a kind of value which the other cannot have. The same principle holds good in regard to other toys. The pair of stilts, the canoe, the frame for the butterfly net,—whatever plaything the boy wants, he should make for himself.

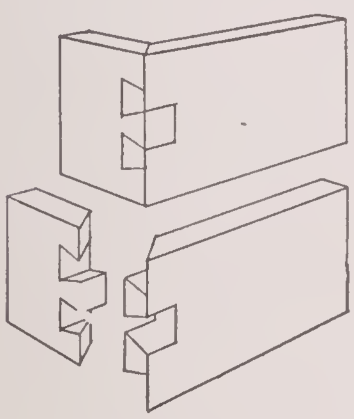


Fig. 153

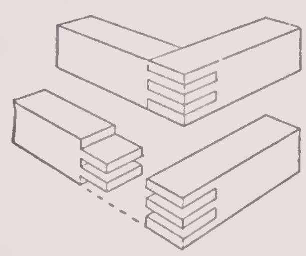


Fig. 154

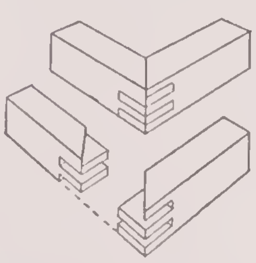


Fig. 155

Then, too, lead him to make things for the house. There are shelves to put up, boxes and chests to make, cupboards to build, and a thousand things to do, if one has an eye to see the need. Nothing should be purchased that can be made in the house. Then the repairs are almost infinite. Doors shrink and must be refitted, locks get out of true and must be readjusted, window cords wear out and must be replaced, and other unexpected calls for repair work are coming constantly. These are often—in fact usually—so slight that it hardly seems worth while to send for a carpenter. But as long as there is a boy-carpenter in the house, do not let these things go over for a day longer than necessary. Not only should his tool-chest and workroom be kept "ship-shape," but the house should be kept right. A door that sticks should be attended to at once and not be left to wear out the patience of every member of the family. That is what the boy-carpenter is for.

Whether the boy should be paid for this sort of work, is an important question. It is safe, and perhaps best, that he should be paid a small sum. But he should be made to feel that he has some responsibility for the condition of the house; that it is as much his business as his father's to look after the general welfare. He should not be paid so as to lead him to look upon the condition of the house, and the comforts of the family, as if he were an outsider. A small payment will help him to keep up his stock of tools and give him a little pocket money, which are good things. But he must never look upon these home jobs as good pickings. He must have the same care as if he were the head of the family and paid the bills. This will do more than almost anything else to make a man of him.

One caution is added. The boy must not be allowed to leave any work half done. When he starts in on any piece of work, whether it be a toy or an article of permanent value to the household, whether he is working for himself or for others, in every case insist that he shall finish. One of the vices with which many boys and men need to contend, is this disposition to shiftlessness. If the first beginnings are overlooked, it will grow like a weed. It chokes out the persistence which in manhood makes things go. It ruins the man and leaves him a laughing-stock. Certainly for nearly two thousand years, and probably from the beginning of civilization, the man who began to build and was not able to finish, has always been the object of derision. But the boy who thus does real work, useful work, and work that is always brought to completion, has a good preparation for the exacting needs which are sure to come in the period of his manhood.

# WOOD-CARVING

Wood-carving has been made an important factor in Manual Training, in this country, and work done by pupils not more than twelve or fourteen years old is sometimes surprisingly beautiful. The educational advantages of a course in this work are large. It goes a step farther than modeling in clay, which produces fragile or perishable forms, while carved wood has a permanent beauty and value. Wood-carving gives the pupil a sense of form and stimulates a love of grace and beauty. When ornamental carving is added to a work of utility which the boy has made in his carpenter shop, it increases the value of the work as well as the pleasure of the worker, and shows that the useful may also be beautiful. The carving applied to a table, chair, picture-frame, bread-tray, ladle, or spoon, does not make those articles less serviceable, but it does make them more pleasing and gives them individuality.

Wood-carving is as really an art as is painting; and it makes large demands on the intelligence, originality, and skill of the carver. Its purely educational value, on general lines, is admitted to be less than that of carpentry, but on the other hand, it teaches much that is not to be learned in common woodwork, and it directly inspires a love of beauty. Like clay modeling, it requires the use of both hands, and a good carver learns to shift his tool from one hand to the other, using both hands with equal dexterity. It is clean and healthful work, and children almost always find great delight in it.

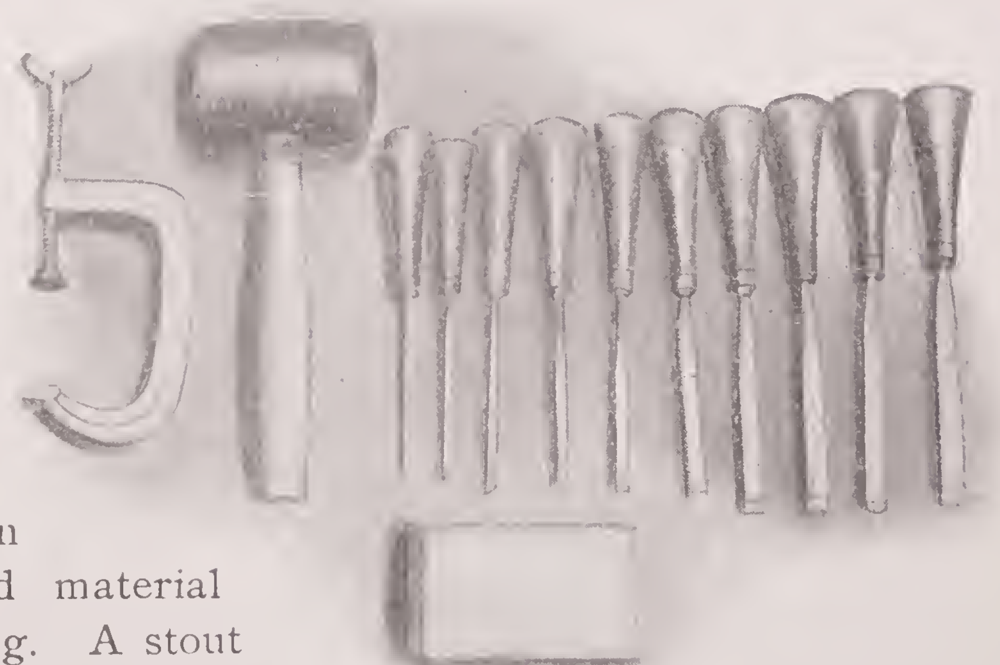


Fig. 1

## TOOLS REQUIRED

No large expense is involved in providing the outfit of tools and material needed for a course in wood-carving. A stout table or heavy bench, which will not "wabble," is needed, and clamps to hold firmly in place the wood to be carved. The kit of tools comprises a mallet, and eight or ten chisels and gouges of different forms. It is a mistake to supply the child with too many tools. The best carvers rarely use

more than six or eight; workmen who employ twenty, thirty, or forty tools generally do poorer work than those who use a less number. Moreover, with few tools at hand the ingenuity of the carver is likely to be developed, when an unusual condition arises in the work. In selecting a set of tools, it is desirable to buy those of high grade. They cost more than those of lower grade, but with cheap tools, good work is often out of the question. Further, it is always penny-wise and pound-foolish to buy an inferior quality of edge tools, for they will not hold their edge, and the time spent in sharpening them makes them dear in the end. An oilstone is needed for sharpening the chisels and gouges.

## THE WOOD TO BE CARVED

Beginners often make the mistake of choosing soft wood for their first experiments. In practical wood-carving, oak, cherry, and mahogany, are most used. It is only now and then that carving is done on soft wood. The learner should, therefore, avoid pine or similar wood, which splinters easily. Oak is the cheapest of the hard woods suitable for carving and it is best to begin with this. It does not splinter too readily and is tough enough to offer the necessary resistance. The reason why it is desirable to use hard wood in learning to carve is the same as the reason why it is best to put regular, full-sized tools in the hands of the beginner in carpentry work: It does away with the idea that the work is play, and familiarizes the pupil with the actual conditions of advanced work. Moreover, beginners often do excellent work at the start, and there is an added pleasure in keeping the object, if it is presentable and, as practical work, worth saving. As wood cannot be used more than once for carving, it is a good plan at first to save all the articles made, and to examine them from time to time, noting the progress made. When the carver has grown so skilful as to produce uniformly good work, the earlier specimens may be sent to the kindling-box.

But the carver should never, even at the first, take up any work with the idea that it is to be thrown away. Children, as well as older people, like to make things which they believe to be of permanent value, and they should have that inspiration in beginning their first work. They should begin their work with the full determination to make it good. It is well to have work that amounts to something. The carver will learn the use of tools better by making articles of real value than by mere experimental exercises, for it will hold his interest to the end.

## THE DESIGN

It is assumed that a course in free-hand drawing and one in clay modeling have preceded that of wood-carving. They should so precede it, in any event. If this has been done, the pupil may select, as a model for his first exercise in carving, one of the forms he has modeled in clay. A good subject to begin with will be a simple panel, four inches square, to be ornamented with a scroll.

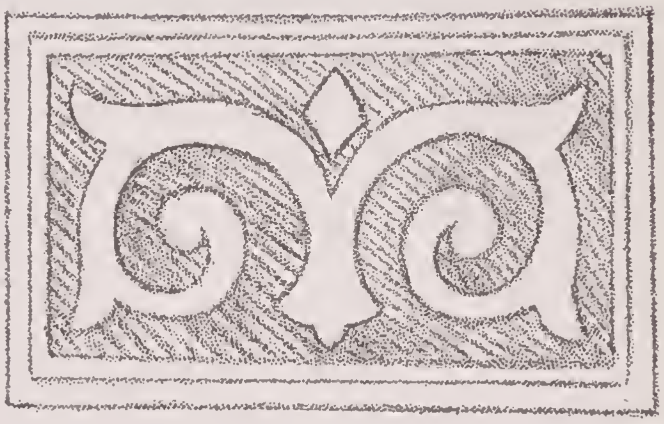


Fig. 2

The first thing to do is to draw the outline of the design on the wood. Mark out, on the surface of the block, a plain edge or border half an inch wide. Inside this border, the scroll may be drawn and redrawn until it is well-balanced and symmetrical. The preliminary drawing should be made with chalk, which can be rubbed off again and again, until the design is satisfactory. Then the outline should be marked with a soft lead pencil. These lines must be heavy so that they will not be rubbed out by the constant friction of the hands and sleeves. When the outline has been thus drawn, the background should be roughly scored with the pencil so as to shade the parts to be cut out. This will serve as a ready guide for the eye in carving, and if it is not done, the chisel will sometimes be applied by mistake to the wrong part of the wood and will cut out that which is intended to be left as a raised surface. This precaution may seem unnecessary, but it is really very important, for the eye does not take in the entire design at every glance, and it needs a reliable guide in applying the gouge or chisel.

The design on the wood should invariably be drawn free-hand. In some schools, pupils are allowed to trace the design by means of a tracing wheel or transfer paper. When the designs are so traced, half the educational value of the work is lost. The carver does not develop his own sense of form when he depends on some other person. The carved work made after such design will always be the feeblest kind of imitation. It will certainly lack the qualities of individuality, strength, and boldness,—qualities which carving is intended to develop. In time, the carver should have so keen a sense of form that in imagination he will constantly see his design in the wood, as it will appear when finished; the pencil marks are to him, therefore, a precaution, not a pre-requisite. Again, there is infinitely more satisfaction in work which is originated and carried through to completion without borrowing the ideas of

others. If a boy can say of a piece of work that he designed as well as carved it, his pride in that work will stimulate him to still better and more original work. The mere copyist misses this pleasure and this stimulus.

It is true that designs are furnished to professional carvers who work on furniture and like articles, and the chief thing required of them is skill in execution. But wood-carving, as a factor in Manual Training, is not intended to produce professional wood-carvers, any more than shop practice is expected to make every pupil a carpenter. It is general education that is sought, and this should not be forgotten.

## PRIMARY INSTRUCTIONS IN CARVING

Place the work-bench so as to have good light. Take the block on which the design has been drawn and secure it firmly to the bench by means of the clamps. The clamps must not slip. At times there will be considerable pressure on the wood, and if the block should move, the design might be spoiled.

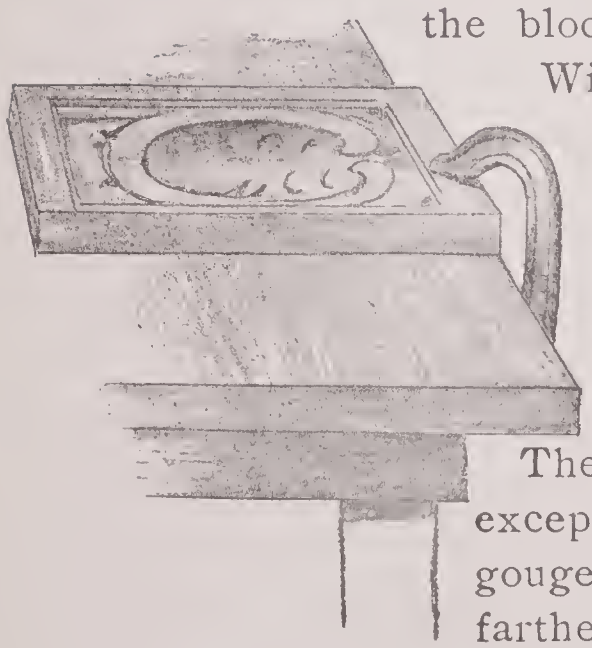


Fig. 3

With a gouge, cut a groove around the design. The groove should not be made deep at first. Then follow with a series of grooves until the entire background has been roughly "scored." Then gouge out the background to a depth of a quarter of an inch and for the present leave it in the rough state. Take care not to cut too deep.

There is no invariable rule for holding the gouge or chisel, except that both hands are employed. One hand pushes the gouge into the wood, while the other, grasping the tool farther down, steadies it and prevents it from going too far. An extraordinary degree of toughness in the wood may necessitate the use of the mallet, which is used to strike forcible, but not violent, blows on the head of the tool. The beginner should dispense with the mallet at first, and use one hand for striking the tool, or rely altogether on pushing it through the wood. Though carving is real work, it is not severe or exhausting. But a certain amount of force must be used. It is excellent discipline for the muscles and develops the strength.

A knowledge of wood — its formation and resisting properties — now comes into practical use, because in carving it is necessary to cut sometimes with the grain and sometimes against it. In shaping a delicate curve, the tool must be held firmly, lest it take off too large

a splinter when going with the grain, or bite in too deep when cutting against it. The right amount of force can be learned only by experience, and this experience develops the sense of touch in a remarkable degree. After a little practice, the hands push the tool forward or hold it back with a precision that insures clean, firm lines. In learning to carve wood, do not be in a hurry. Remember that there is plenty of time. "Haste makes waste." It is better to spend three days on a single piece of work and do it well than to finish it, after a fashion, in a single day and then be ashamed of it. This does not mean that the work should lag, or that the cutting should be done by "pecking" at the wood in a succession of short, choppy strokes. The strokes should be bold and continuous, so as to leave no irregular, patchy marks; but only a small amount of wood should be removed at each stroke.

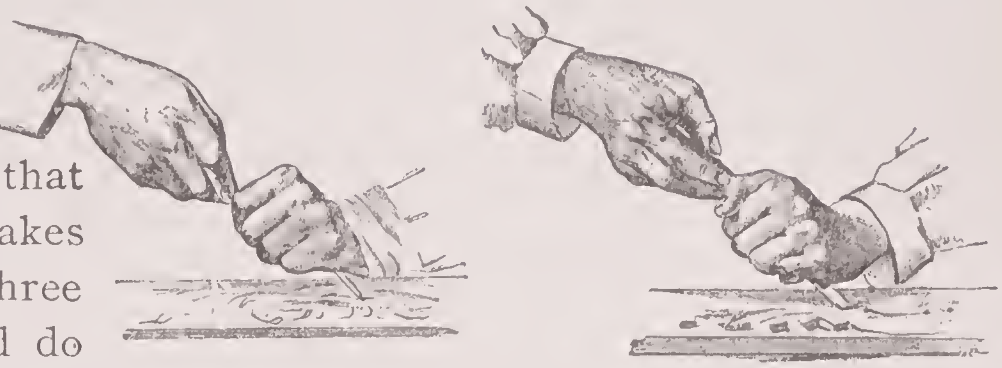


Fig. 4

When the background has been roughly gouged out, the next thing is to shape the curves according to the penciled design. With a chisel whose curve is not too abrupt, cut the wood to a clean, sharp edge along the line. In doing this, the chisel is held vertically and tapped with the mallet. Be careful not to cut the edge too deep. It is important to select the proper tool for this work. A tool whose curve is more abrupt than that of the design will make a "scalloped" edge, which cannot afterward be successfully smoothed. If the curve of the chisel is too slight, the projecting angles left by successive applications of the tool may be more easily cut away; but it will be found that a set of chisels which offers a choice of five or six curves, includes tools to fit almost any curve used in design.

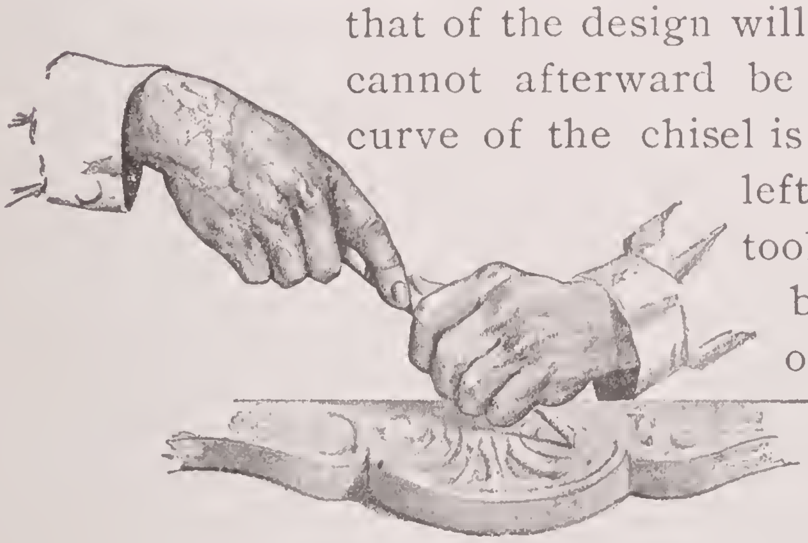


Fig 4

When the entire background has been gouged out, and the design cut to sharp edges, the carver is ready to shape the raised surface. At this point, the work becomes more difficult. Previous knowledge of modeling, gained from working in clay, is of great assistance, for the carver must now model the wood as really as he modeled the clay.

The edge of the design is now at right angles to the plane surface. It is desired to form the curves. Draw lines on the wood to show how far from the edge the wood is to be cut away. Select a gouge whose curve is suited to the curves to be shaped, and then, with a firm, even stroke, begin to cut off the inner edge of the curve. A thin shaving only should be taken off at each stroke. This work must be done with close attention to the progress of the tool through the wood. The edge should be cut away to about half the depth of the wood above the background.

To shape the outer edge, select a chisel that is nearly flat, and bevel the wood to the line previously drawn. If there are crockets on the scroll, be careful not to chip them away by accident. Let one hand push the tool forward while the other checks it, and the wrist, resting on the wood, serves as a center support. If by accident you chip off one of the small projections, let it go for the time being. In first attempts, the thing most desired is familiarity with the use of the tools.

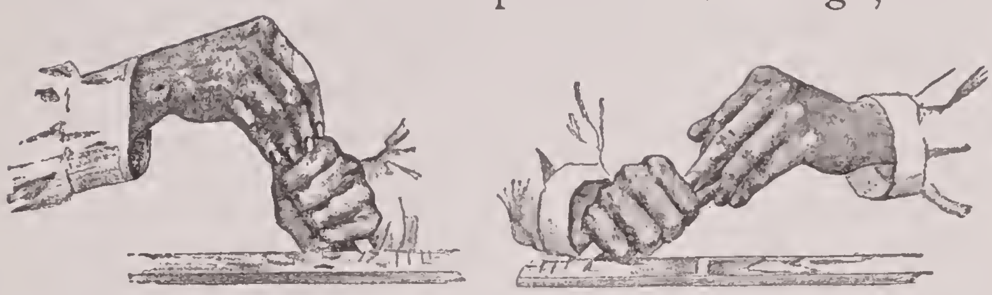


Fig. 5

When all the curves of the design have been neatly rounded, and no more work remains to be done on the raised surface, a finish may be given to the background by chipping it, allowing the chisel marks to show, but making the surface fairly even throughout. Another way to finish the background is by "stamping." A large nail the end of which

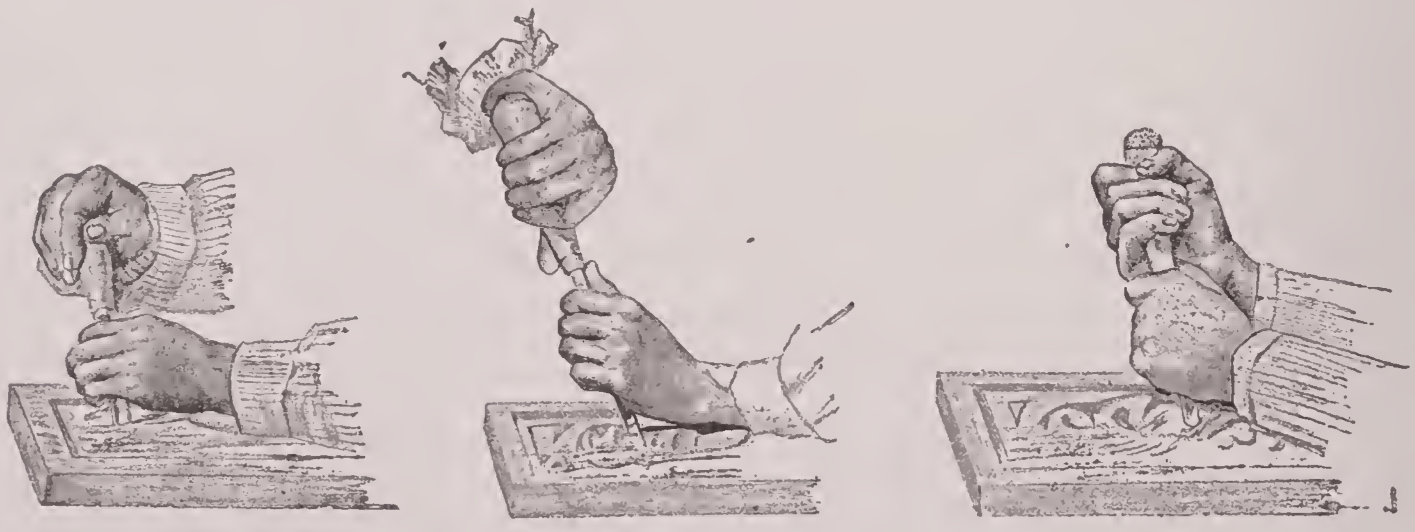


Fig. 6

has been filed to the shape of a diamond, a circle, or a square, may be used for this work. Hold the nail in a vertical position and tap the head with the mallet, going over the entire background and taking care not to make the indentations too deep. This will produce a pleasing effect, like that obtained in painting by stippling with the brush.

When the first panel has been completed, it may, after all, be a disappointment. Probably it will be, and it is desirable that the carver should see where his work might have been made better. But the parent or teacher should give encouragement, not by insincere praise of the work itself, if it is crude and rough, but by expressing interest and urging the learner to press forward. Every beginner needs this encouragement. It is most depressing to plod along without having some notice taken of honest effort. When it is practicable for him to do so, the pupil should go and watch a practical wood-carver at work, noting how easily the wood yields to his skilful strokes, and how rapidly the work assumes beautiful form. What he does, anyone can do who has had the necessary experience.

Wood sometimes seems to the young carver to be possessed of "evil spirits." It is tough, and the grain seems to play fantastic tricks with the tool, now leading it to make too deep a cut and again refusing to yield the proper curve. Patience paves the way to skill. The carver may require several hours for shaping his first scroll; when he has acquired more skill, the same amount of work can be done in a fraction of the time.

It is necessary, in carving a scroll, to change the direction of the tool several times, in order to humor the grain of the wood. Sometimes the wood will develop a "soft" place, the tool will slip and the lines of the design will appear ragged. But it is not well to throw the panel aside as soon as an error has been made. The first panel should be completed as if it would be perfect when done, and greater care used in carving the remaining portion. This gives the needed training, and the second panel is more likely to be free from errors.

Whoever has it in charge to see that the young carver is encouraged in his work, should insist on his following a definite line of progress. The simple panels will not long satisfy the learner. After the first few attempts, he will be anxious to take up a more ambitious piece of work — a large mirror-frame, for example, or a chair. This will not do. Only when he attains real skill, and fully understands the peculiarities of wood, will it be possible for him to do such work well. It should be the rule to begin with the first simple panel and progress gradually through a series of forms, each a little more difficult to execute than the one preceding.

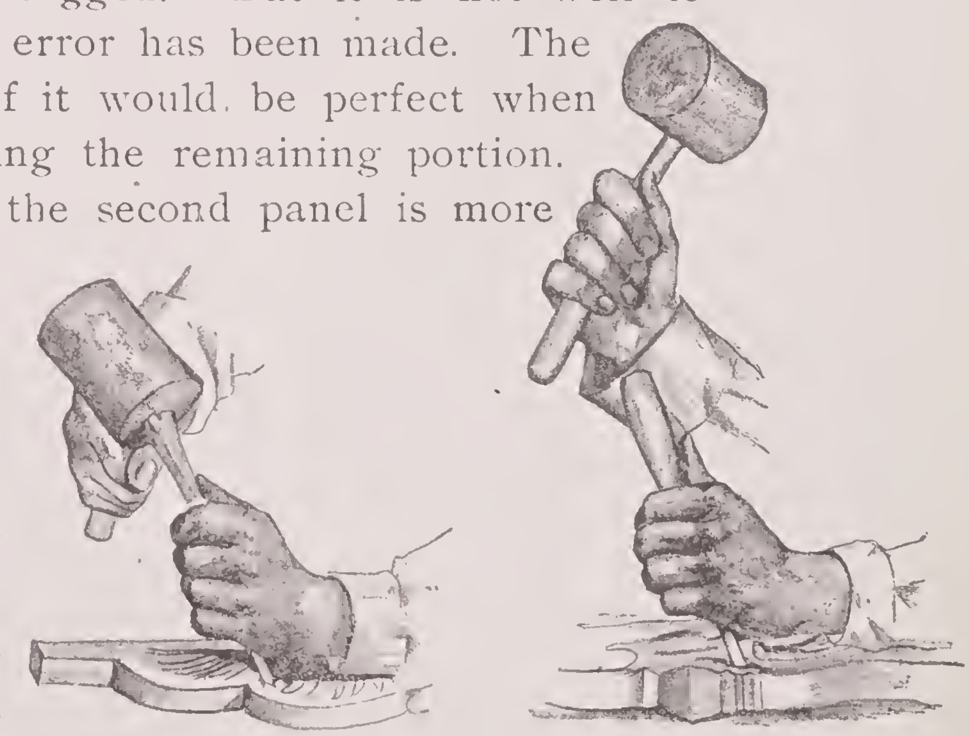


Fig. 7

## ELEMENTARY WORK

Scrolls, and conventionalized forms of nature, are largely employed in designs for wood-carving. Elementary work in carving is largely based upon the use of these forms, which may be very simple at first and then more complex and full of detail, as the carver improves.

For the first lesson, take a panel on which a spiral is to be carved. Draw the design, first in chalk and then in pencil. Gouge out a

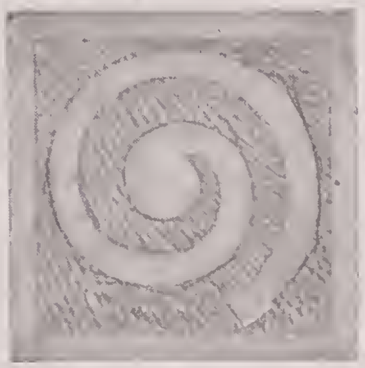


Fig. 8

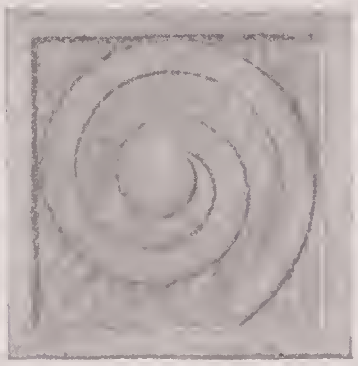


Fig. 9

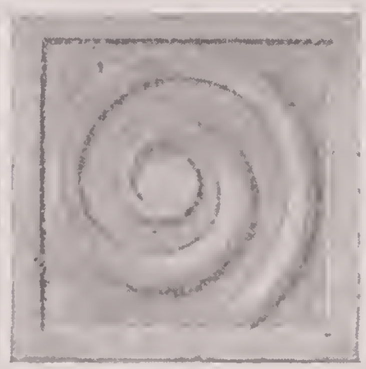


Fig. 10

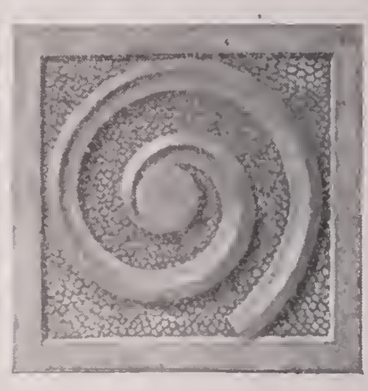


Fig. 11

groove around the outline and then roughly cut out the background, according to the instructions already given. Now comes the second stage, when the edge of the design is carefully chiseled and lines are drawn to serve as a guide in shaping the curves. In the third stage, we have the gouging out of the inner side of the spiral and the beveling of the outer side. Figure 10 shows the completed work with the edges carefully finished, and the background stamped to an even surface. A glance at the completed form shows its value in training the hand to make free, sweeping curves with the tool. It is necessary to acquire facility in this before it is possible to make substantial progress in carving.

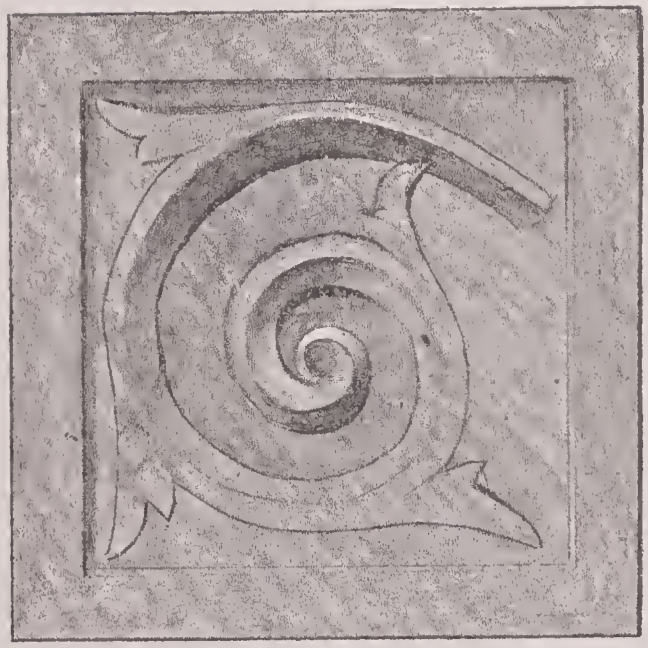


Fig. 12

For the second lesson, the carver may undertake a panel presenting the same spiral, embellished with crockets. This is a much more difficult piece of work. The tool cannot sweep so freely around the curves, owing to the interruption of the crockets. Unless care is taken, the tool will gouge into the crockets and spoil their form. If one of the crockets is thus

Fig. 13

injured, do not attempt to better it, but be more careful in carving the others.

The third lesson may be upon a leaf panel. If the pupil has already modeled a leaf in clay, he will find the carving easier than it would be otherwise, because his sense of form will have been developed directly along this line. The steps in this work are the same as in the preceding. When the background has been removed and the outline chiseled, the surface of the leaf may be partially modeled; then, with gouges of suitable curve, the rounded surfaces should be formed, and finally the ribs of the leaf neatly outlined with the parting tool.

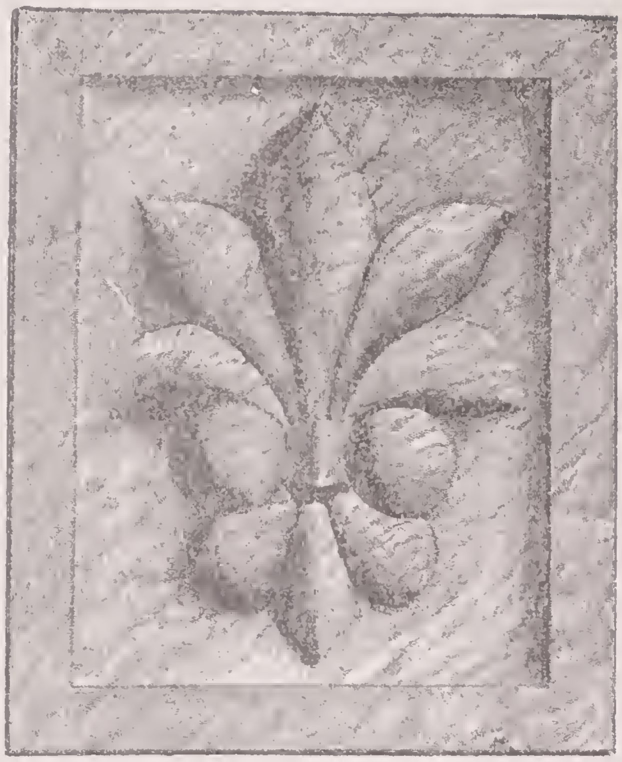


Fig. 14

The fleur-de-lis offers a good subject for the fourth lesson. This is not so easy as it looks, for the rounding of the surface must be done with great care, and to make the curves of the lobes uniform will test the carver's skill. For finishing the lobes, use a chisel with a very slight curve. It is always desirable, especially in this work, to have the tools sharp.

After the pupil has become skilful in carving the simple leaf forms he is ready to undertake a rosette. A glance at almost any piece of carved work will show to how great an extent various styles of rosettes are used. The rosette affords a good starting point for almost any piece of work, and is frequently used to ornament corners, to break a long border in the center, or at intervals, and in many other ways. The first figure shows the preliminary work. A circle is drawn with the compasses to show where the circumference of the rosette will be, and at the center a smaller circle to indicate the space reserved for the boss. A groove is cut inside the large circle and the edge of the boss is cut off sharply. Between the two, the wood is then scooped out with a gouge, so as to present a concave surface. The gouge must not plunge too deep, or there will not be sufficient wood for carving the design. This is now drawn, first with chalk and then with pencil. A leaf form, repeated four, six, or eight times, with stems centering at the boss, gives a pleasing effect. It must be remembered that all parts of the rosette will be lower than the wood surrounding it, and so the chisel must not go too deep when you begin to carve.

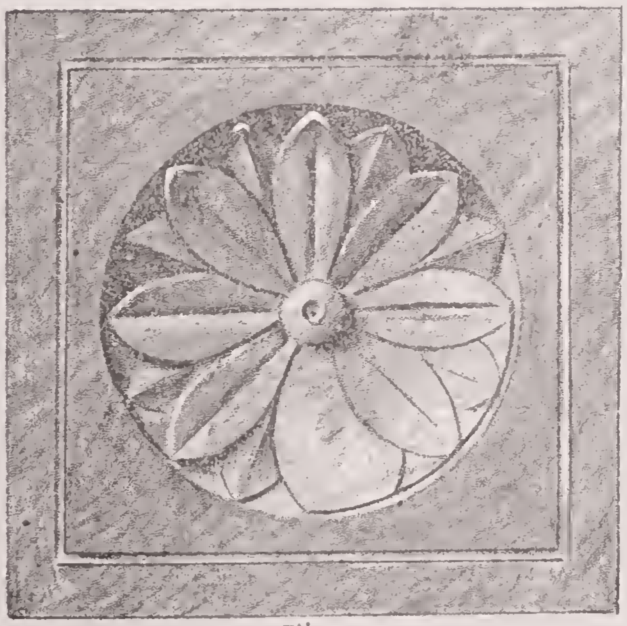


Fig. 15

Select a chisel of suitable curve and cut down the edges of the leaves. Use the parting tool to cut out the ribs at the center of each leaf. The finishing work will present some new difficulties, because of the hollowing surface, and the wood should be taken out in thin shavings. The boss may be rounded, like a ball, or hollowed out, or beveled from the center.

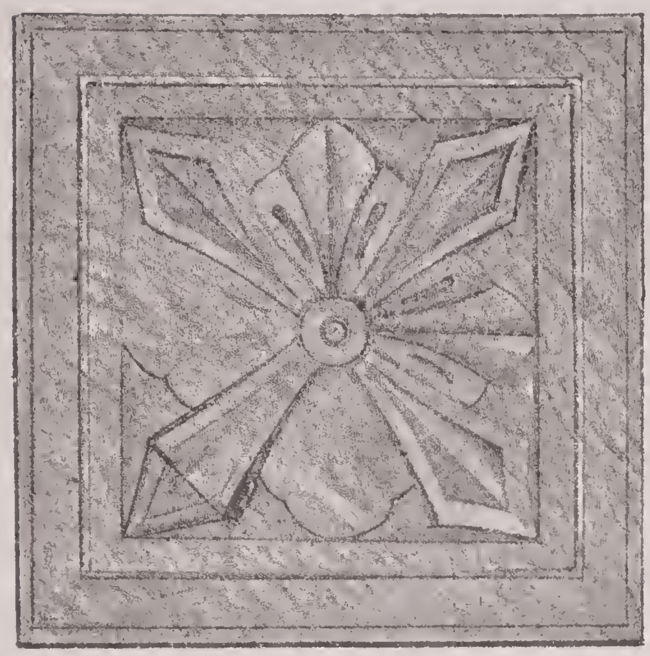


Fig. 16

Square rosettes are often employed. In making these, the diagonals may be drawn with a ruler and the spaces marked off with the compasses. The design is then completed by free-hand drawing. First cut out the background; then form the edges of the leaves. Cut out the inner parts of the leaves and make the background deeper. In finishing, use a nearly flat chisel to form the outer surface of the leaves, and a gouge of proper curve to shape the inner portions.

Conventionalized shell forms are good subjects for carving. These may be made according to the methods already described for rosettes, or they may be fluted. Fluted work is very beautiful. It calls for clean, even chiseling. A fluted rosette is shown in the illustration. The wood should be scooped out and the design be drawn as already indicated. The parting tool is then used to model the rays, and the

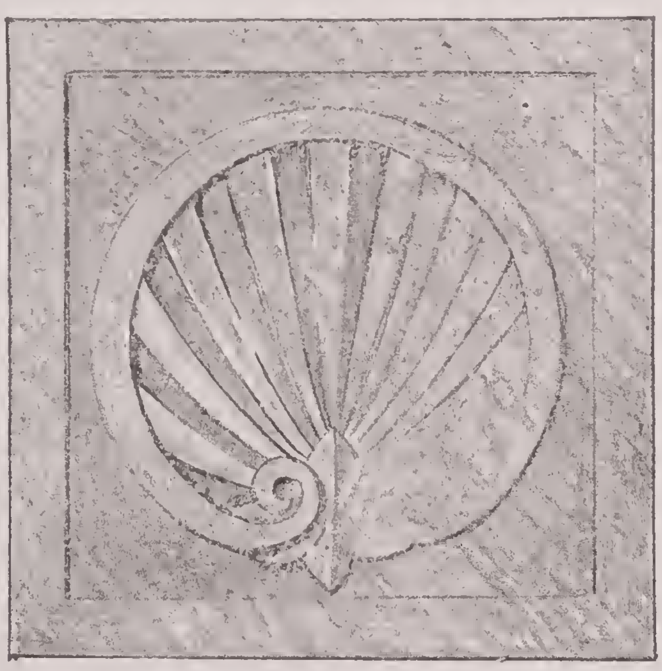


Fig 17

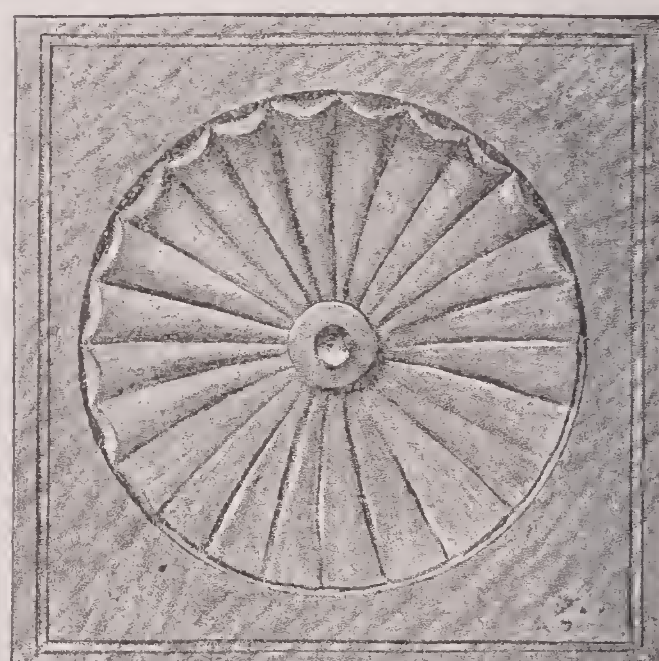


Fig. 18

edges are rounded with a curved chisel. The parting tool is used in the same way in modeling the concave shell forms, an example of which is illustrated in Figure 18.

Thus far, work has been done upon flat surfaces only. As the pupil grows more skilful, he will be prepared to take up carving in relief and to work on curved surfaces, which is much more difficult than making simple panels like those already described.

The making of ornaments for furniture demands skill in advanced work of this kind. Look at any common bookcase and you will see that it has at least some pretense of ornamentation by carved work, even if the latter is no more than a simple border. Much of the "carved" work on cheap furniture is now produced with the aid of machinery, but the original carving must have been first executed by hand. The machine can follow, but it cannot create.

On a strip of wood suitable for a border, mark off a series of equal spaces, some a quarter of an inch in width, some half an inch. Do this with the compasses, so as to secure accuracy. With a flat chisel, make an incision in the wood at each of the points marked by the compasses. This will indicate the division-point between the beads. Flat chisels of various sizes may now be used to shape the beads into balls, or rounded points. The beauty of the bead-work will depend upon the regularity of the beads in size and shape. If one is cut too small, it may be left until the strip has been completed. Then cut it out altogether and glue in its place a piece of wood which, when dry, may be modeled to conform to the other beads. It is often necessary to repair carved work in this manner, and the repairing can be done so neatly that the patchwork will not be noticed. The young carver should learn to do this, and by correcting his mistakes in this way, he will save himself from the discouragement that would otherwise come from the failure of his work as a whole. Beadwork of this kind is good practice, for it teaches accuracy; and as beadwork is employed more or less on all carved work, from picture-frames to chairs and tables, it should be mastered at an early stage.

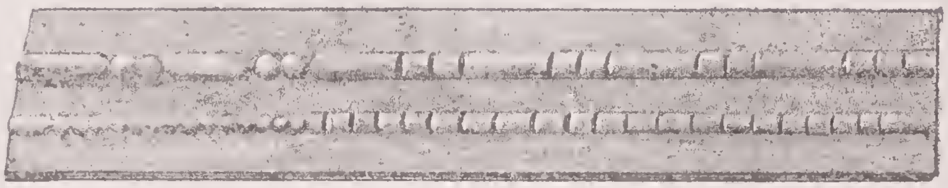


Fig. 19

Fig. 20

A more ornate form of border is the egg-dart molding, which is shown in Figure 20. This is a common molding and therefore a good one for practice. When we have learned the forms of common things which are all about us, yet are never or rarely noticed, we are better able to see and to carry away impressions of new forms.

Strips of wood which have been shaped into plain moldings by machinery may be had from dealers in mill-work, and these should be purchased. It is a waste of time for the beginner to take a squared stick and groove it by hand throughout its length. The same amount of practice may be had in design work and there is little compensation for the time lost. Moreover, it is very difficult, even for a good

workman, to groove a long stick as accurately and as neatly as it can be done by a machine.

With the molding in hand, the first work is to space the stick with the compasses, and then to draw the outline of the design with a soft pencil. With a parting tool form the edge of the eggs and the darts, as shown in the illustration. Now cut out the background with a sharp gouge and curve the darts. The cutting should not be done to the full depth until the form has been brought out. Then the background may be sunk to the proper depth and the finishing work be done, with great care to have the darts look alike and the eggs rounded so evenly that none will look too wide or too narrow as compared with its neighbor. Work of this character, where the same form is repeated several times in succession on the same piece of wood, is excellent training for the eye as well as for the hand, and is very effective in imparting a correct sense of form. Instead of carrying the first form through from beginning to completion before attacking the second, it is better to do the preliminary work on all before undertaking to finish a part. This will insure greater uniformity.

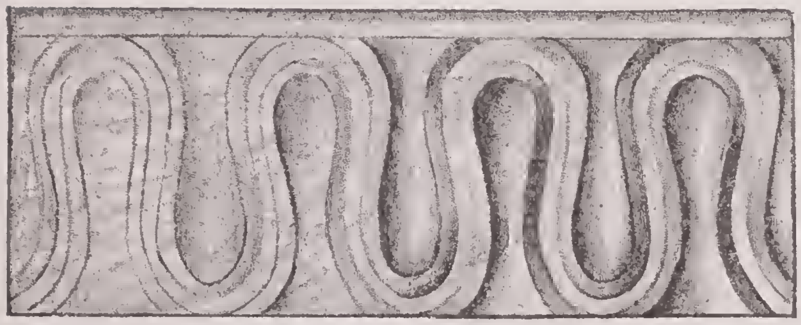


Fig. 21

Do not limit the work to one form of molding, but work on several forms. In one, introduce a series of interlocking curves, like that shown in Figure 21. This work will bring into use the practice obtained in making the first scrolled panel. A more difficult form is a leaf molding, in which the top of the leaf is curved forward. After drawing the design on the wood with a soft lead pencil, form the outline in a shallow groove, with a curved chisel. With the parting tool form the rib in the center of the leaf. Then hollow out the wood between the two leaves from a line midway between them, which also represents the rib of the leaf partially concealed behind the two. Curved chisels and gouges may now be used to give the leaf the necessary depressions. To carve the projecting tops of the leaf is not an easy matter. Have a care that the projection be not broken off altogether. But if such an accident should happen, a new piece may be glued on, as already suggested. Gouges of different shapes may be used to hollow out the under part of the leaf-top and for forming the upper surface. The edge may be shaped with a curved

Fig. 22

chisel. To make these projecting tops uniform will seriously test the skill of the carver at first, but after practice the work is not formidable. The chief difficulty in mastering this part of the work arises from the fact that the eye cannot take in the outlines of all the leaf-tops while work is being done on one of them. They must, therefore, be frequently compared while the work is in progress.

By the time the pupil has thoroughly mastered the carving of the work already suggested, so that he can carve boldly, skilfully, and accurately, he has learned to control his tools and knows all there is to know of carving, except that delicacy of touch and sense of form which come from long experience. But so far as knowing how to attack the work is concerned, he is ready to undertake more elaborate pieces. Before he puts his gouge to the wood, however, he will do well to model his work in clay. With the knowledge of modeling, previously acquired, and his recent experience in carving, fresh in mind, he will be able to do this quickly and well. Original design is desirable, but this should be guided by correct taste. There are both good and bad forms in carving, and so far as the carver has opportunity, he should study the approved work of experts. In architectural iron and marble work, and in furniture, there are beautiful designs which he may study before making his clay model. If he has no regular instructor, this will be an essential part of his training. Even in the smallest and poorest towns there are always some designs worth studying. In cities they are found on every hand, in the stone, wood, and metal work of fine buildings, in museums, libraries, courthouses, churches, and in federal buildings. Go to a store that carries a stock of the best furniture and study the carving of tables, chairs, and cabinets. Some pieces will be very elaborately carved; on others, the carving will be quite simple, yet withal very beautiful. When the young carver examines these objects, he will see that they were modeled by men who used the same sort of tools that he uses, and made the same strokes that he has learned to make. The superiority of their work comes partly from their greater dexterity and skill, but more from the greater development of their sense of form and their appreciation of art — the ability to distinguish between good form and bad form. All these beautiful forms the young carver may reproduce, giving them a touch of his individuality, if he will put thought, care, patience, and self-discipline, into his work.

A picture-frame offers a good subject for advanced work. Before designing this it is a good plan to select the picture for which the frame, when completed, will be used, and have in mind the effect that will be produced by the framed picture. If it is a small water-

color in which neutral tints predominate, the frame may be a simple border. If it is much larger, an oil painting, or an etching rich in strong contrasts, a much heavier frame will be suitable, and it may be more richly carved. The frame for a mirror may be made of heavy wood and it will bear an elaborate design. The beauty of such a frame, carved from a solid piece of wood, and its superiority over a frame made of mitered molding nailed together, is apparent to any eye, and such a piece of work, skilfully executed, will afford great satisfaction to the worker.

Fig. 23

Blanks for chairs—backs, seats, arms, and legs—may be purchased, and on these careful work may be done. In work of this kind, simplicity of design is most effective, for the beauty of the finished object will be seen not so much in a multiplicity of details as in graceful curves, delicate modifications of leaf and shell forms, and the like. The first pieces attempted should not be too ambitious or difficult, but they should be within the scope of the carver's capabilities.

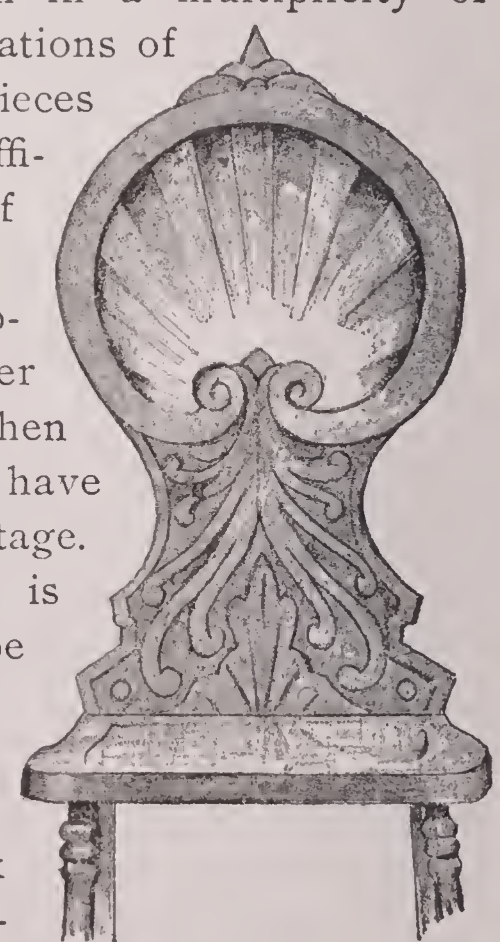


Fig. 24

While wood-carving, as outlined in this chapter, is intended to serve an educational rather than a utilitarian purpose, bear in mind that when the carver has made sufficient progress he will have no difficulty in selling his work to good advantage. Where the original outlay for tools and blanks is a tax upon the purse, this feature is not to be despised, although it should always be held secondary to the real purpose of education. There is, too, a substantial satisfaction to the carver in the thought that he is producing work that will undergo the candid test of commerce—that is, that people are willing to pay money for it. Clock-cases, frames for mirrors and pictures, cabinets, book-racks, chests for linen or silver, chairs, tables, and many other articles,

may be carved and sold at good prices. The demand among all classes of people for more artistic surroundings has increased phenomenally in the past few years, and there is an individuality about carved work that makes it especially attractive.

By diligent application in this field, the student who must count his coins carefully, and husband the pennies, may earn the means to pursue his studies further and so work his way through, as we say of self-supporting college men.

But there is another use which the wood-carver may make of his products, a use which is more important than the financial consideration. He may decorate his home. He will naturally begin with his own room, and little by little extend his decorations to the hall, the parlor, and throughout the house. This will enable him to live, as it were, in an atmosphere of art. His parents will have just pride in him. The visitors will share in the pleasure of his artistic work. The home will be *his* home in a more profound sense. His thought, his labor, his skill, will be visible on every side, and every member of the family will feel the subtle influence of the consecration of art.

Even more valuable than this should be the influence of the work on the character of the worker. He sees some beautiful form in nature, adopts it as his own, and then sets out to reproduce it in the terms of his art. With loving patience, with manly earnestness, he brings all his skill to bear on this task. It is the creature of his affection and devotion. Slowly it grows toward perfection and embodies the beauty that was imaged in his own heart. When it is complete it is a joy to the worker. Its beauty is a part of his reward. This work, when done in the right spirit, cannot fail to have a deep reciprocal influence on his own character. Far more than the artist guessed, he was, while carving those outward forms, adding the beauty of spiritual grace, and the strength of enduring manliness, to his own character.

The value of wood-carving is thus seen to have a wide reach. Its influence is visible in the culture of skill in the hand, in the drill of certain intellectual qualities, in the encouragement of esthetic taste, in the indirect but powerful influence on character, and finally in the wide diffusion of pleasure. Such work is more than mere pastime: it is education of the best type.

# SLED

The first snow never fails to excite in the healthy boy a desire for coasting. A sled is necessary for his peace of mind, and, incidentally, for that of the family.

The bob-sled, or double runner, is the best kind of sled, for it carries more people and goes further than any other kind.

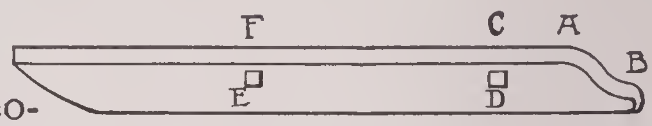



Fig. 1

To make a bob-sled, get 12 feet of ½-inch pine, 3½ inches wide. On your plank mark off four parts of 3 feet each. Cut out of a piece of brown paper a design like Figure 1. Using this as a pattern, trace round it on your pieces of wood and cut out with a draw-knife, making from A to B, 4 inches, and from C to A, 3 inches. D is a hole an inch square, made with a chisel. The top of D is ½ an inch from F A. E is another inch-square hole 15 inches from D and likewise ½ inch from F A. E and D are holes made to receive the cross-bars of the sled. Now cut out your other pieces of wood after the same manner.

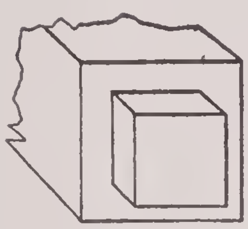


Fig. 2

Next obtain some oak — four pieces, 11 inches long and 1½ inches square. Mark off ½ inch from each end, cut out the ends as in Figure 2, making the shaded portion 1 inch square, so that they will fit into the holes E and D in Figure 1, as in Figure 3. The ends should fit tightly in the holes, as it would not be strong unless they did. Then drive a good wire nail through each to keep them in place.

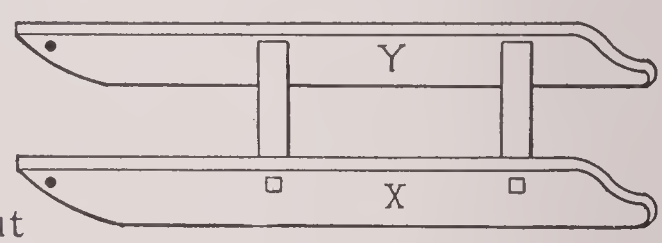



Fig. 3

Now get four common iron hoops; get a blacksmith to cut them in two pieces and shape them so that they will fit tight at the ends of X and Y, and leave a little space between the iron runner and the wood, to act as a spring. (See Fig. 4.) Screw the ends A and B of the iron runner to the wood, but do not put any more screws in it or it will not be springy.

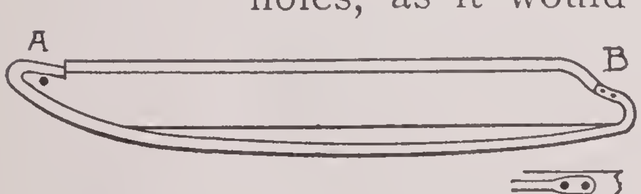



Fig. 4

Then you will need some more wood: A piece of elm, 4 feet long and 10 inches wide and ½ inch thick. Cut this in two to make the top boards of the sleds. Cut them out to this design. Now screw them on the cross-bars of your runner. Next make a hole in the middle of your first seat, and two about 1½ inches

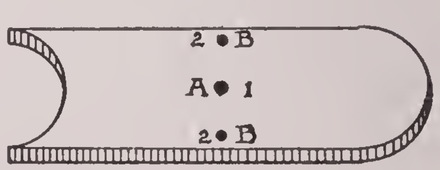



Fig. 5

from the edges of the boards and at the middle, as in Figure 5. You will now have two strong sleds. (See Fig. 6.)

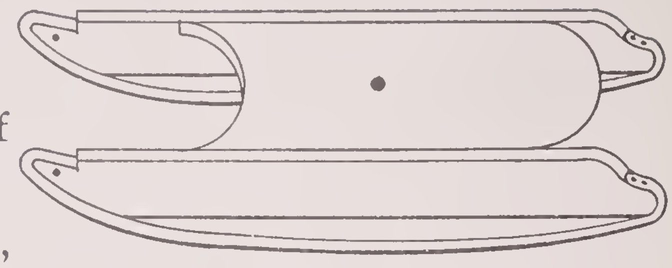


Fig. 6

Now you will want 9 feet of 1-inch planking 10 inches wide, and two blocks 12 inches by 7 inches by 4 inches. The blocks had better be made of pitch-pine. Bore a hole in the center line about 10 inches from the end, and bore two holes about 10 inches from the other end, and each about $1\frac{1}{2}$ inches from each side, as in Figure 7. Bore a hole through the center of your first block, lengthwise, to correspond with the hole A, Figure 7. Then bore two holes in the second block, lengthwise, to correspond with the holes B and C in your plank. Next, you will want three bolts 14 inches long to go through the 1-inch plank and then through the 12 inches of the block and then through the $\frac{1}{2}$-inch board of the sled, as in Figure 8. Screw a nut on each of the bolts under the sleds, and your double runner will be complete.

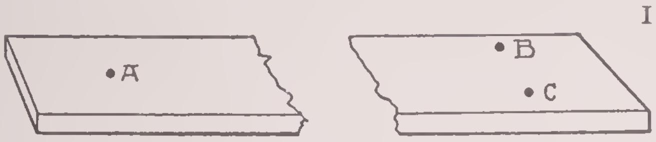



Fig. 7

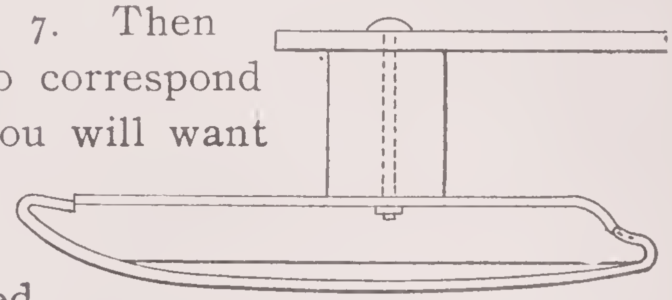


Fig. 8

# SAILING PUNT

BEFORE a boy is intrusted with the management of a sailboat, he should learn to swim. Learning to swim is not hard for a boy who has a good chance, nor is it hard to master the art of sailing a boat. But how to get a sailboat of his own presents usually a much more difficult problem. It generally involves the expenditure of more money than the average boy ever has at his disposal. But there is another solution of the problem for the boy who has learned to use his tools: it is to make a boat. I propose here to tell him how he can make a small sailing punt that will be both seaworthy and speedy. It is assumed, of course, that he knows something about boats to begin with. Otherwise he would better get some nautical friend to make things a bit clearer than can easily be done on paper.

To begin with, obtain four good, sound boards of yellow pine, 11 inches wide and $\frac{5}{8}$ of an inch thick, planed down to $\frac{1}{2}$ inch; some $\frac{3}{4}$-inch stuff for cutting up; and a piece of hard wood, say oak, about 3 feet by 3 inches by 2 inches, for stem and stern posts. Then proceed to cut up as follows: Cut two of the boards into sides (Fig. 1); make two pieces to form a well amidships to carry canvas decks fore and aft. (Fig. 2.) The stem and stern posts will follow, 12 inches by 2 inches, made in the form of an angle (as shown in section in Fig. 4), with a groove into which the sides fit nicely. (Figs. 3 and 4.)

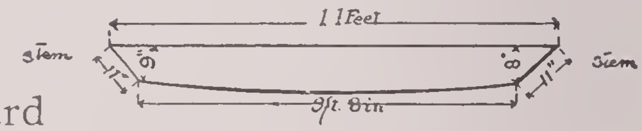



Fig. 1

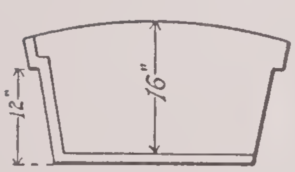



Fig. 2

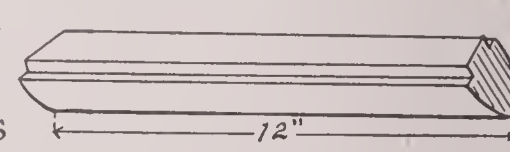



Fig. 3

Fasten the sides with brass screws to the stem and stern-posts, binding them carefully over the two well-pieces or bulkheads, and it will assume the form indicated.

Fig. 4

Out of the two remaining boards a bottom must be cut and fitted. To make this wide enough, two small lengths of hard wood are fastened at A, A, A, A, (Fig. 6), which will also act as a defense when being hauled over the stones. To make the bottom firm, some crosspieces, B, will be needful inside. These must be fitted in after screwing on the sides.

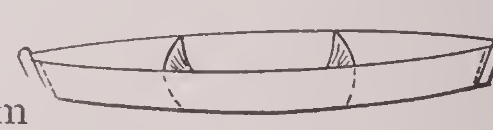


Fig. 5

The keel consists of a straight piece, 6 inches by 9 feet $3\frac{1}{2}$ inches, shaped to fit the bottom, and rounded at the stem and left sharp at

the stern. It may be fastened to the boat with galvanized 3-inch screws and washers, easily procurable. Four galvanized holdfasts must be also fitted into keel and bottom. All the joints and seams should be made water-tight by a layer of brown paper smeared with white lead, placed between the junctures. Two side-pieces to raise the bulwarks will be needed, $5\frac{3}{4}$ inches by $3\frac{1}{2}$ inches, and rounded as shown in Figure 10. Two pieces will also be required, one 6 inches by 23 inches, for the mast-hole forward, and one $22\frac{1}{2}$ inches by $1\frac{1}{2}$ inches for supporting back rest of seat aft. The seat is a board $22\frac{1}{4}$ inches by 11 inches, raised 1 inch from the bottom, and $1\frac{1}{2}$ inches away from the aft bulkhead. The back rest of the seat is of two pieces, 18 inches long, and two pieces, one 10 inches at the top, and one 8 inches at the foot. This is let into the seat board and made to lift out.

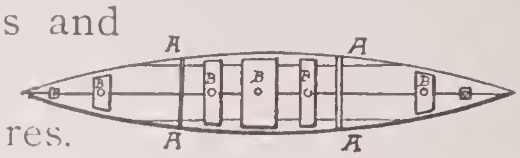


Fig. 6

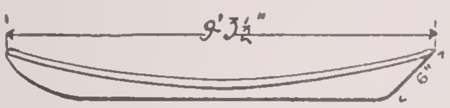


Fig. 7

A good thick piece of rope painted white is put round all, as in Figure 10, and passed through a hole in the sternpost, hauled tight, and spliced at the bow as ornament and defense. The rudder should have the yoke lines carried through eyes (Fig. 10), and fastened with a figure-8 knot to prevent them from slipping. A thick leather ring, which should be passed through an eyebolt in the stempost, is needed for the painter and for hauling up. Canvas decks should be provided fore and aft, and nailed with brass brads. Two ropes should be fastened over the coamings of the well. These compartments, of course, should be made water-tight, or filled with virgin cork cuttings. Bladders may be substituted. A door, 1 foot by 6 inches, in that event may be made in the bulkhead, transforming it into a locker. The bladders fastened into pairs, with strings a yard long, may be found useful. If shipwrecked, you will simply draw your sheath-knife (which you will always carry in your belt for all purposes), rip up the canvas and pass the string round the breast and under the arms, and you will swim, even if you can't swim. With such compartments, you will not mind shipping seas.

The paddle is made of a good 6-foot pole, $1\frac{1}{8}$ inches in diameter, shaped so as to be thickest in the center. At each end a slot is made, into which the blades are screwed; the blade having been strengthened (Fig. 8) with a band of iron or brass. Two rubber rings will keep off the dripping of the water.


Fig. 8

A pine mast, planed almost to a point, 6 feet long and $1\frac{1}{4}$ inches in diameter where thickest, will answer well. A child's spade, cut into gaff-jaws and carefully let into a bamboo 39 inches long, and bound with wire, will make an excellent gaff. The boom, also of bamboo, is 6 feet long.

Instead of a gooseneck, a piece of leather strap, whipped to the mast with copper wire and passed through an eyebolt let into the boom, will do admirably.

The mainsail and jib, of calico, must be cut as shown in Figure 9. The mainsheet must run up the mast upon brass rings, and be laced on the gaff. The halyards will pass through the piece with mast-hole (Fig. 10), and fasten to cleats along the bulwarks.

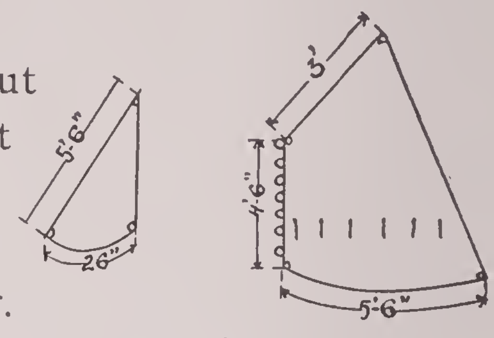



Fig. 9

A galvanized-iron center board, bolted to keel, 3 feet long by 7 inches deep and $\frac{1}{8}$ inch thick, is a necessary help in sailing to windward, and for steadying ballast. Wood, of course, may be used instead of galvanized iron, but it does not steady so well.

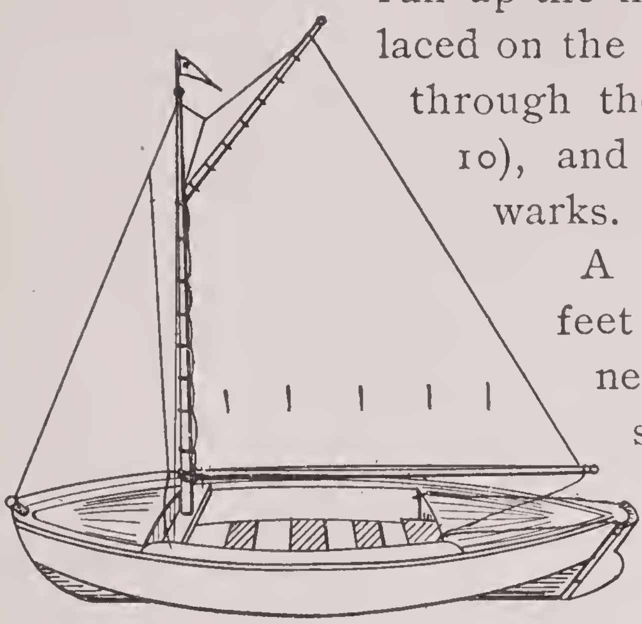


Fig. 10

When all is completed, the boat should be painted French gray outside, the canvas decks white, and the inside of two shades of blue, the bottom and seats being of the darker shade. The final effect and appearance will be an agreeable surprise.

# PICTURE FRAMES

In these days of cheap publications, good pictures are much less expensive than suitable frames. By following the instructions given below, novel, inexpensive, and artistic picture frames can be made, and the boy who makes them may succeed in satisfying his elders that the time he has spent on his tools has not been wasted. To make the frames, will require only a few simple tools, such as an ordinary saw, with fairly fine teeth, a tenon-saw, a small hammer, brad-awl, screw-driver, pair of scissors, some glue, glue-brush, screws, nails, and glass-paper. Any kind of wood may be employed, but wood that is easily cut, renders the task of the young frame-maker less difficult.

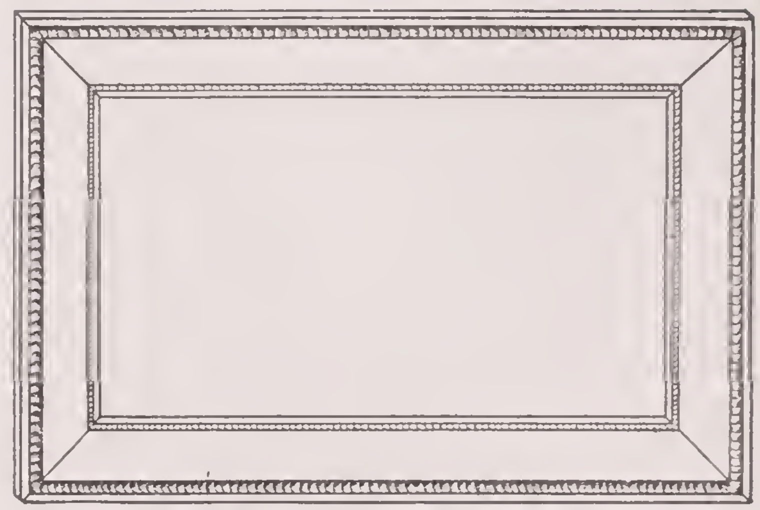


Fig. 1

The next matter to be decided is the size of the frame, which, of course, is governed by that of the picture. Suppose, for instance, that the opening for the picture in Figure 1 is twelve inches long by seven inches high, and the width of the wood three inches. Proceed by selecting pieces of wood near these measurements, then with your ordinary saw cut them into the correct widths, the saw being guided by a black lead-pencil line, which has been marked upon the wood by the aid of a straight-edge or ruler. Now comes the miter, or corners, of the frame, which should be fitted accurately. To do this cut out from some stout cardboard or tin a triangle as A, in Figure 2. Then place it upon the top end of the left-hand piece of frame, carefully mark with pencil where the line C is shown, next cut carefully through with the tenon-saw. Then turn the triangle over to B, which is the top of the frame, proceeding as before. These two corners, being thus treated, and carefully cut, will fit evenly together; the operation, of course, is to be repeated at the three other corners of the frame.

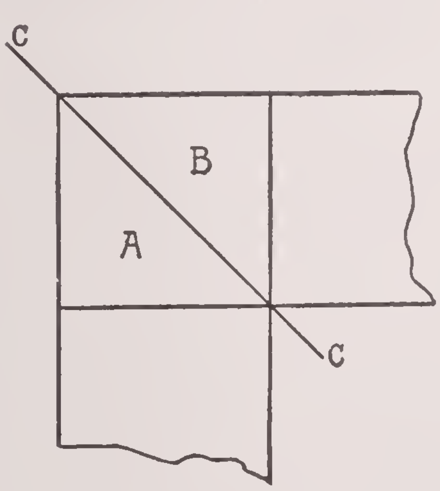



Fig. 2

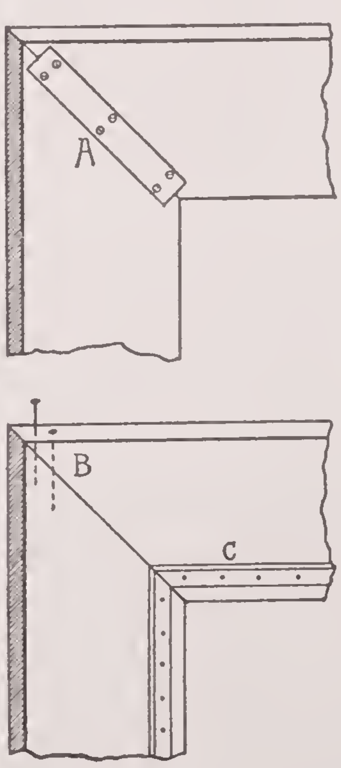



Fig. 3

Figure 3 gives two methods of joining the frame together. First use glue, next bring the two corners of the frame closely together. Then

a piece of wood, A, about three-eighths of an inch thick, is screwed on the back of the frame as shown, using short screws that will not go through the frame. The second method is to glue up as before, and then nail the corners together as seen at B; one nail is shown driven home, the second partly in.

All frames, whether for prints, water-colors, or oils, will require a rabbet, or resting-place, for the glass and the picture, which is a piece of wood, shown at C, Figure 3. When used for prints and glass, the rabbet should be about one inch wide, and a half inch thick. For oil-paintings no glass is necessary, but the thickness of the wood should be at least one inch. A quarter of an inch of frame all around will be quite enough for the glass and picture to rest against. In the case of prints and water-colors, a stout cardboard backing will be required to support the picture in its place, and prevent the dust getting in; the whole is now tacked into the rabbet C — the latter itself being held in position by the aid of glue and brads.

Having made the frame, the decoration must be attended to. Figure 1 shows a rope pattern around its inner and outer edge. This is either genuine rope, or very thick and well-marked string. Cut off a sufficient length, next carefully glue around the frame where the rope is to be fixed, then lay down one end of your rope upon the moist glue, driving a pin through it, and so right round the frame, using the pins at the distance of one inch apart.

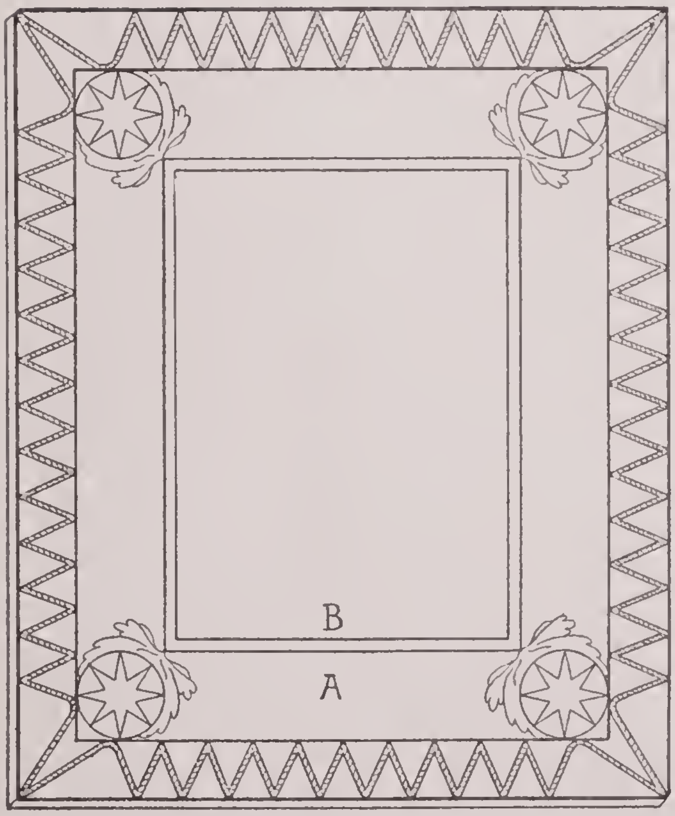


Fig. 4

When the rope patterns are finished, paint the whole frame yellow with distemper color, made by mixing one-third of size to two of water, which must be made hot — don't boil it; then add some powdered chrome, until the whole is about the thickness of cream. Both the size and color can be purchased from most oil-shops. Use it while warm, and cover well the whole of the front and sides of the frame. When dry, paint over the front of the frame with gold paint, of which there are many excellent varieties. Use a soft brush, and take care to be continually stirring the gold paint when applying it, so as to get an even and equal surface all over the frame. If properly laid on, one coat should be sufficient.

Figure 4 shows another rope-pattern frame, the rope being fixed on by the same method as in Figure 1. First carefully mark the pattern with pencil. A is a very thick cardboard frame fixed down upon the wood frame with stout glue; B is also another frame, but composed

of a narrow and thin strip of wood, held in its place with glue and brads. The four corner decorative pieces are cardboard glued upon A. This frame, if painted gold, has a very pretty effect.

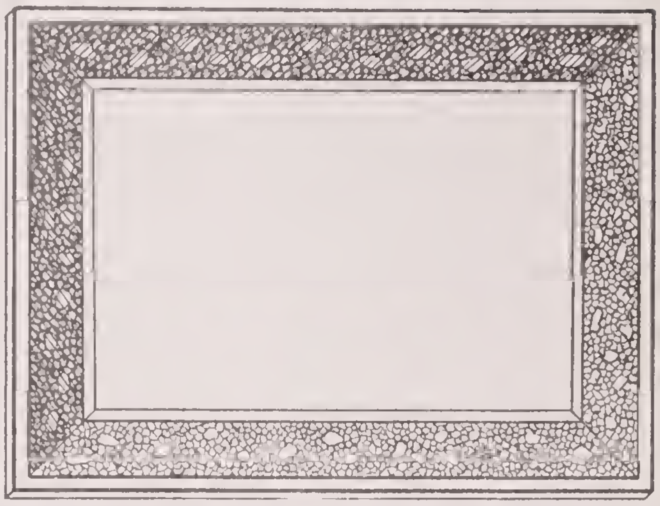


Fig. 5

Figure 5 is a sand frame. The plain wooden frame should be well coated with hot, thin glue, then quickly sprinkle thickly upon it some clean and dry silver sand, gently pressing it down upon the glue. When dry, the surplus sand can be shaken off; and the whole painted with gold paint. This makes a pretty, sparkling gold frame.

In Figure 6 is shown a frame with an outer and inner border quite plain, and made of wood about three-quarters of an inch in thickness, which must be securely fixed upon the frame with plenty of brads. Have ready a quantity of small fancy sea-shells, which must be well cleansed by washing them in several waters; also some small pebbles, sand, and a few dried starfish. Then cut from stout brown paper and thin cardboard various pieces to imitate seaweed; when the borders are fixed upon the frame, they will form a kind of tray nearly one inch in depth. In a basin, mix some plaster of Paris with water — a small quantity at a time, as it very soon sets, and then becomes unmanageable. It should be about as thick as milk. Pour some into the frame, about half an inch in depth, and then quickly, before it hardens, set your shells, pebbles, sand, and starfish upon it, pressing them just far enough down to fix them securely. If the various objects are well and

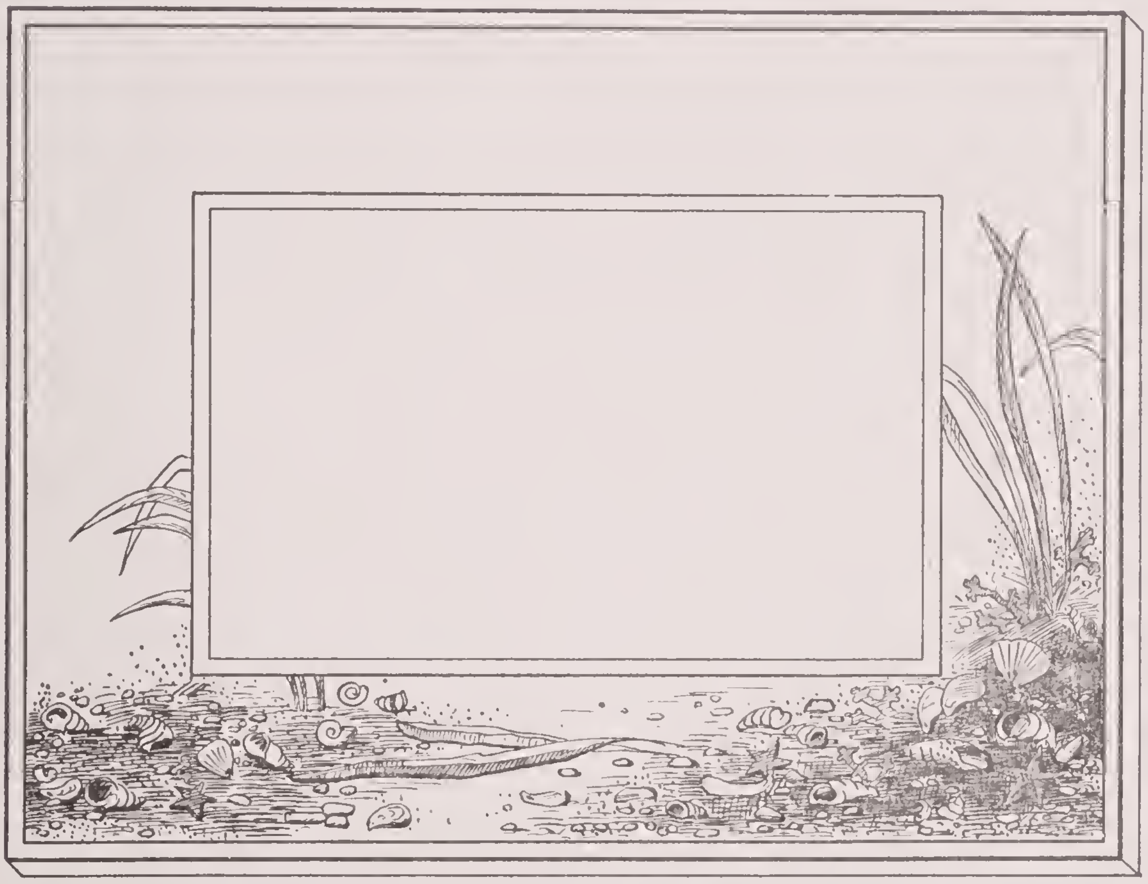


Fig. 6

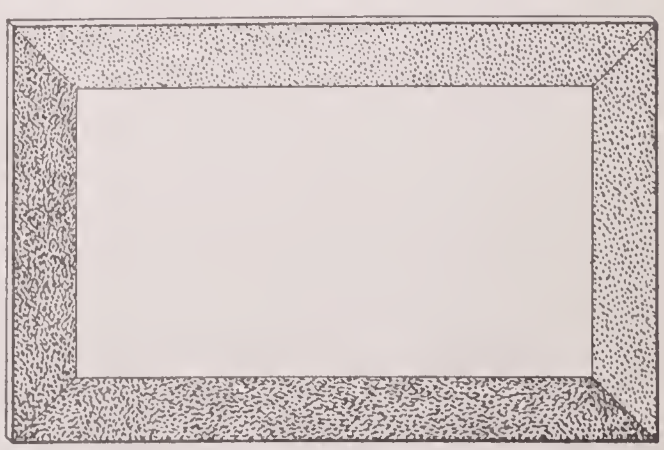


Fig. 7

tastefully arranged, they will form a capital gold frame, especially for marine pictures.

Figure 7 shows a frame to be treated in exactly the same manner as the above. The only difference is that nothing but pebbles of various shapes and sizes are used. This frame in gold has a very neat and pretty effect.

# RUDIMENTARY DRAWING, MODELING, AND HANDICRAFT

CHILDREN who have acquired the use of compasses, rule, and square, may proceed to model forms and make articles of considerable intricacy, as soon as they have learned to draw correctly the Square, the different Triangles, the Hexagon, Octagon, Rhombus, and Rhomboid.

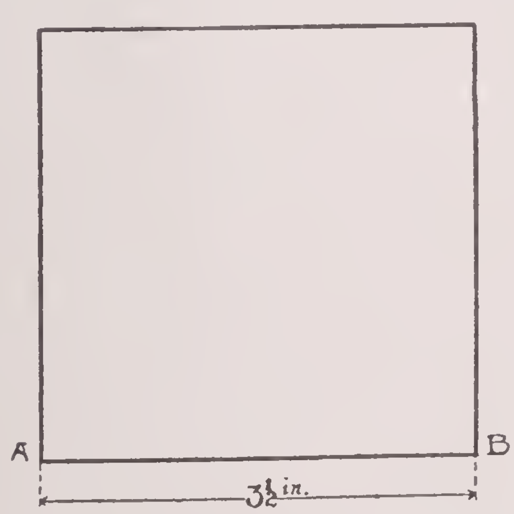
The following examples are intended to furnish them with this preliminary training:—

## SQUARE

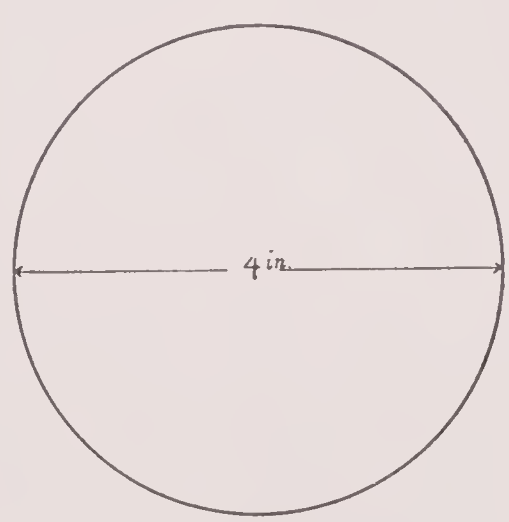
1. Draw a horizontal line 3½ inches long.
2. Erect perpendiculars 3½ inches long at A and B, using triangle.
3. Complete square.

## CIRCLE

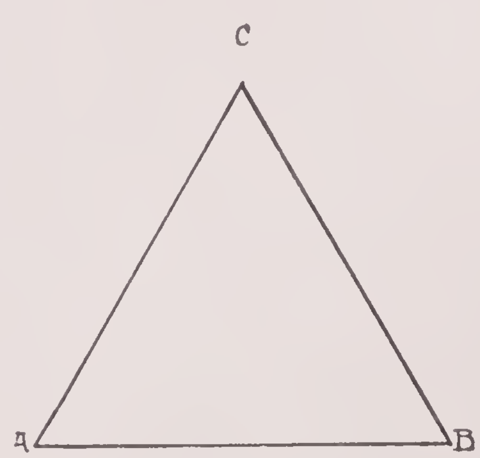
Describe a circle, 2-inch radius.




Square




Circle




Equilateral Triangle

## EQUILATERAL TRIANGLE

1. Draw a horizontal line AB, of any length.
2. Take B as center and BA as radius and describe an arc.
3. Take A as center and AB as radius and describe an arc.
4. From the point C, where the two arcs cut one another, draw lines to A and B.

## ISOSCELES TRIANGLE

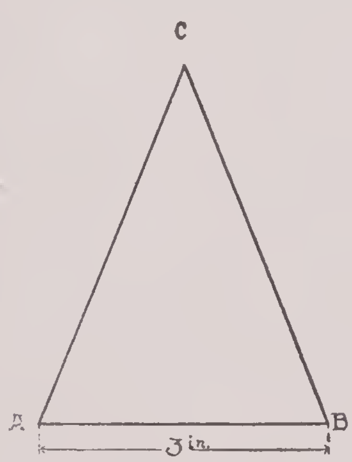
1. Draw the base AB, 3 inches long.
2. With center A and radius 4 inches long, describe an arc.
3. With center B and the same length of radius, describe an arc.
4. From C, the point of intersection of the arcs, draw lines to A and B.

Note.—Any length of radius greater than one-half of the line AB may be used.

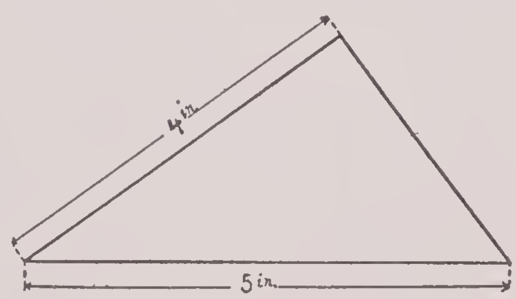
## SCALENE TRIANGLE

(*A triangle having its sides of unequal length.*)

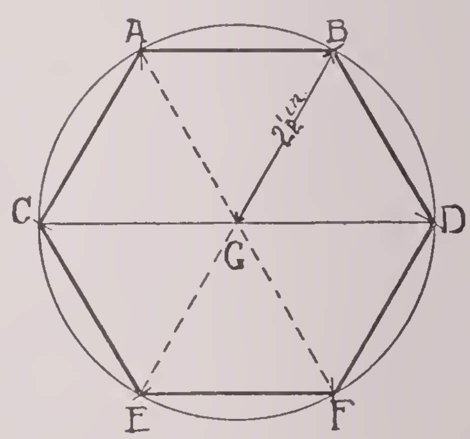
1. Draw a line, 5 inches long.
2. With one of the extremities of this line as center, and radius 4 inches long, describe an arc.
3. With the other extremity of the line as center and radius 3 inches long, describe an arc.
4. From the point where the two arcs intersect, draw straight lines to the points the extremities of the line.




Isosceles Triangle




Scalene Triangle




Hexagon

## HEXAGON

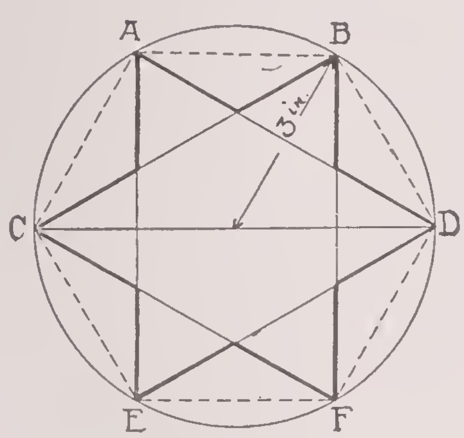
1. Describe a circle, radius 2½ inches.
2. Draw the horizontal diameter CD.
3. With center C and radius equal to that of the circle, describe arcs cutting the circle at the points A and E.
4. With center D and with the same radius, describe arcs cutting the circle at the points B and F.
5. Draw in the lines AB, BD, DF, FE, and EC.

## HEXAGONAL STAR

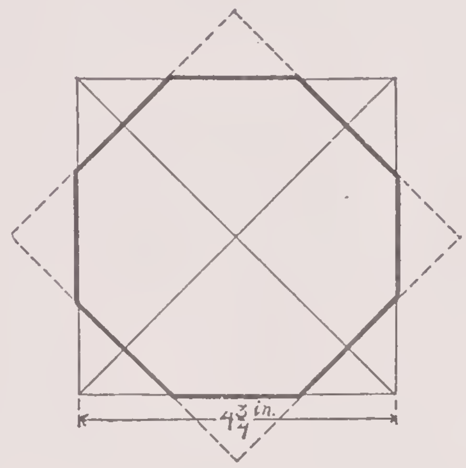
1. Describe a circle, radius 3 inches.
2. In it construct a hexagon as in the preceding exercise.
3. Draw the triangles AED and BCF.

## OCTAGON

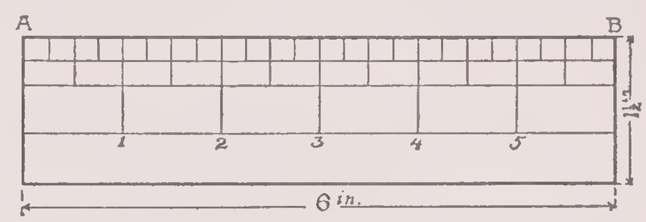
1. Construct a square.
2. Draw the diagonals.
3. Describe arcs, using the corners of the square as centers and a radius equal to one-half the length of the diagonal.
4. Connect the points where the arcs cut the square and thus complete the octagon.




Hexagonal Star



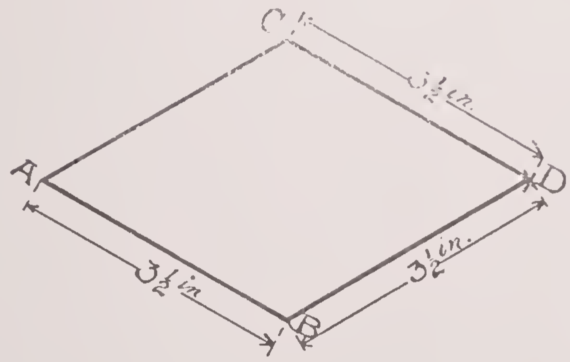

Octagon



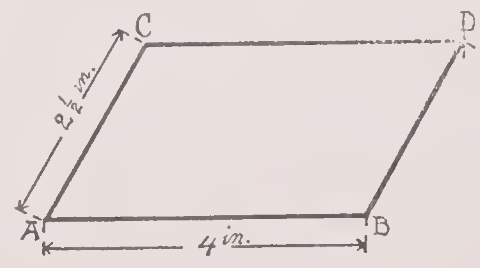

Six-Inch Rule

## SIX-INCH RULE

1. Draw a horizontal line AB 6 inches long.
2. Upon it construct a rectangle 1½ inches deep.
3. Along AB mark the inches and half-inches.
4. On AB mark ¼-inch spaces.
5. Draw a line ¼ of an inch from AB, and connect it with the ¼-inch divisions by means of perpendiculars let fall upon it.




Rhombus




Rhomboid

## RHOMBUS

1. Draw the base AB.
2. Draw an oblique line AC, length = AB, through A at any convenient angle to AB. (60 degrees.)
3. Take AB as radius, and B and C respectively as centers, and find D.
4. Connect D with B and C.

7—16

## RHOMBOID

1. Draw the base AB, 4 inches long.

2. Draw AC, of any length greater or less than AB, at any convenient angle to AB. (60 degrees.)

3. With C as center and AB as radius, describe arc.

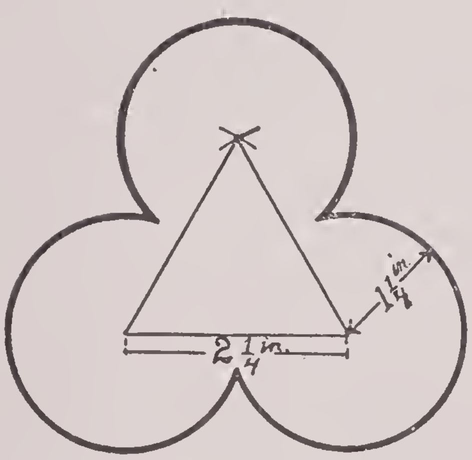
4. With B as center and AC as radius, describe arc, the two intersecting at D.

5. Connect D and C, and D and B.

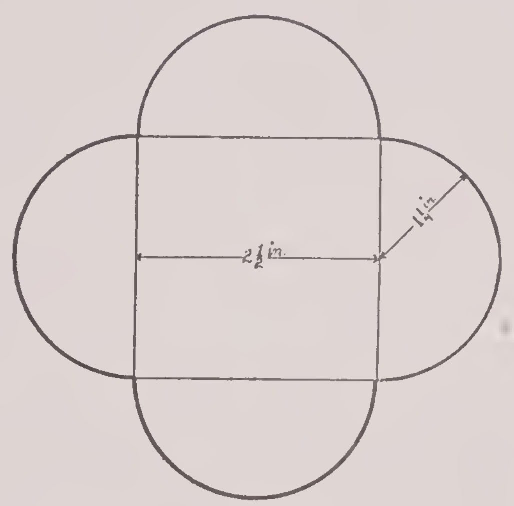
## QUATREFOIL

1. Construct square, side 2½ inches.

2. Find center of each side and construct semicircles.



Quatrefoil



Trefoil

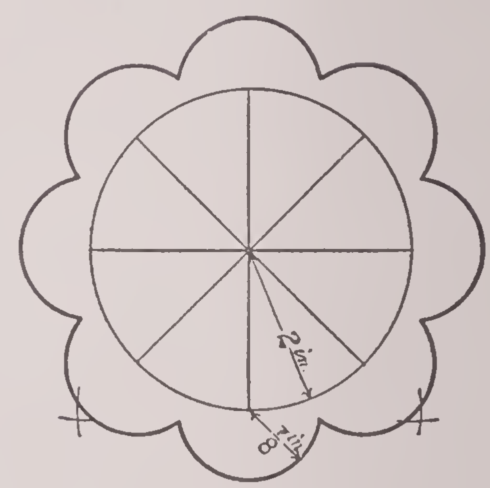


Table Mat

## TREFOIL

1. Construct an equilateral triangle, side 2¼ inches.

2. With corners of triangle as centers and 1¼-inch radius, describe the arcs.

## TABLE MAT

1. Describe a circle, 2-inch radius.

2. Draw the horizontal and vertical diameters.

3. Bisect quadrants, using the compasses, and draw the diameters.

4. With extremities of diameters as centers, describe the arcs forming the outline of the model.

## FOLDING EXERCISE

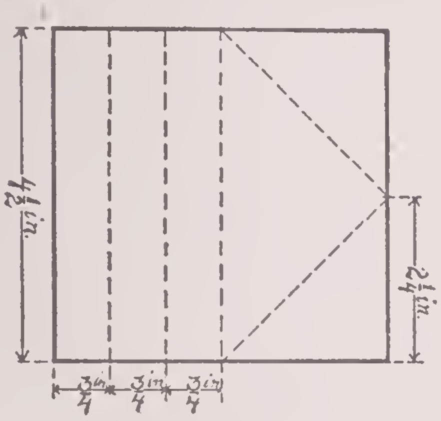
1. Construct square 4½ inches.

2. Draw dotted lines ¾-inch apart.

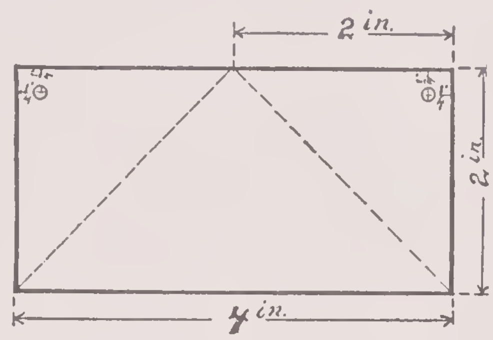
3. Fold on dotted lines.

## BOOKMARK

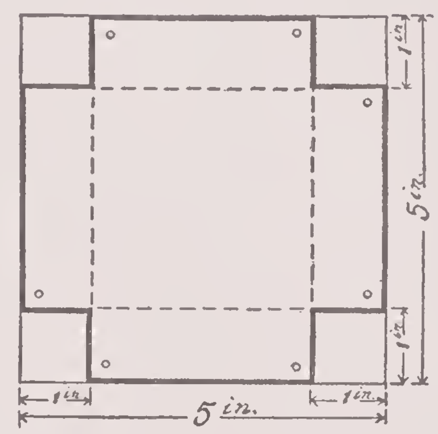
1. Construct the rectangle 4 x 2 inches.
2. Find the center of one of the long sides and connect it with the ends of opposite side.
3. Fold on dotted lines, and tie with twine or ribbon through holes ¼-inch from the edge.




Folding Exercise



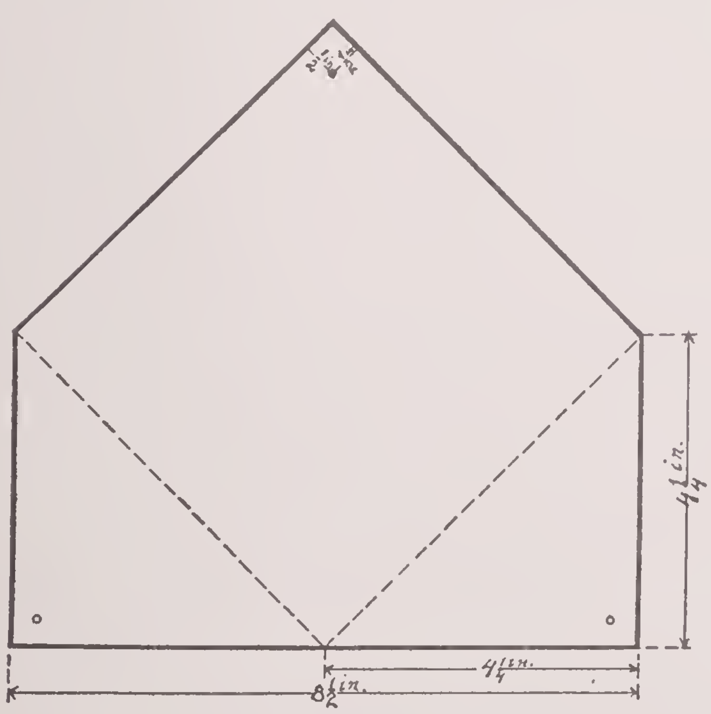

Bookmark



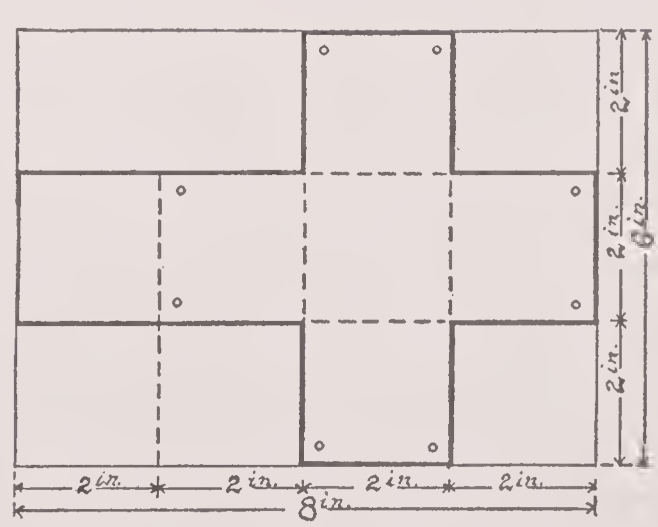

Square Box

## SQUARE BOX

1. Construct square 5 inches and draw lines inside square.
2. Cut out the corner squares, fold on dotted lines and tie.




Wall Pocket




Cubical Box

## WALL POCKET

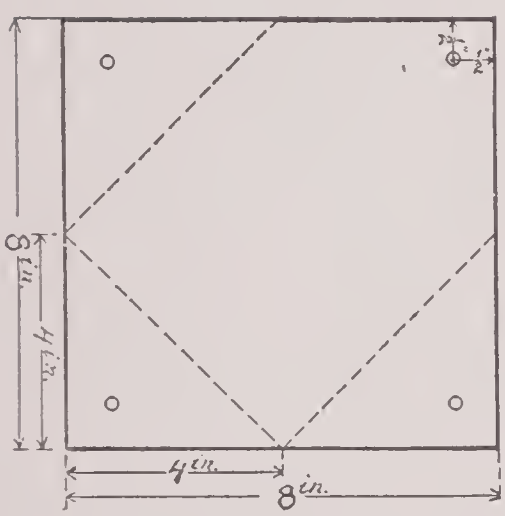
1. Construct square 8½ inches.
2. Find center of sides and connect.
3. Cut away the upper triangles, fold on dotted lines and tie.

## CUBICAL BOX

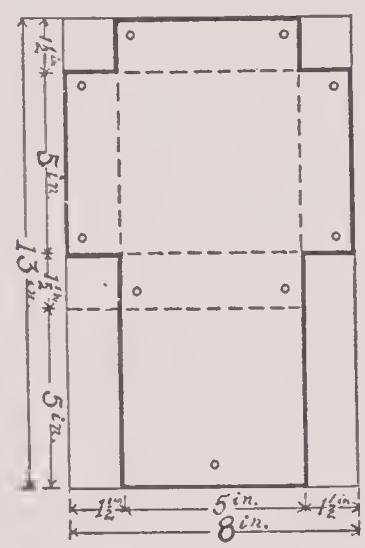
1. Construct rectangle 8 x 6 inches.
2. Divide sides into 2-inch spaces and connect opposite points.
3. Cut away the parts outside of the heavy lines, fold on dotted lines and tie.

## CATCH-ALL

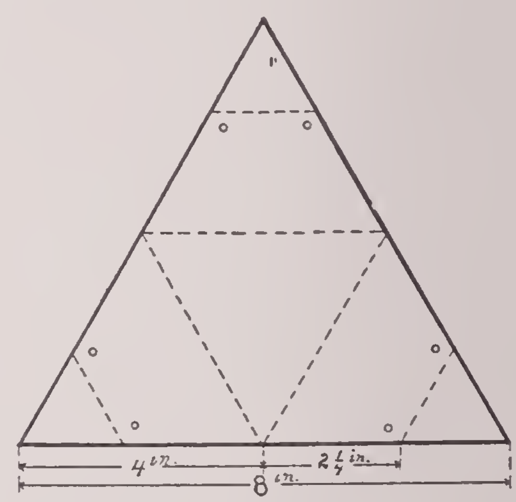
1. Construct square 8 inches.
2. Find centers of sides and connect.
3. Fold on dotted lines and tie.




Catch-All




Handkerchief Box




Candy Box

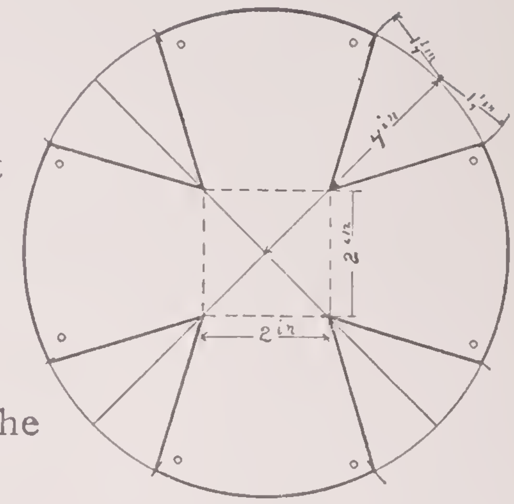
## HANDKERCHIEF BOX

1. Construct rectangle 13 x 8 inches.
2. Measure off on long sides 1½ inches, 5 inches, 1½ inch spaces; on short sides measure off 1½ and 5 inch spaces.
3. Connect opposite points.
4. Cut, fold on dotted lines, and tie.

## CANDY BOX

1. Construct equilateral triangle, 8-inch base.
2. Connect centers of sides with dotted lines.
3. Draw dotted lines 2¼ inches from and parallel to those just drawn, measuring on the sides. These last lines should be on the other side of the cardboard, therefore they have to be drawn on the cardboard after the 8-inch triangle is cut out.
4. Fold on dotted lines and tie.

## BASKET



Basket

1. Construct a 2-inch square, and draw diagonals.
2. With radius 4 inches, and center the intersecting point of the diagonals, describe circle.
3. Extend diagonals to circumference of circle.
4. Measure off 1¼ inches on the circumference on each side of the diagonals, using compasses.
5. Connect these points with corresponding corners of the square.
6. Cut out on black lines, fold on dotted lines, and tie.

## MODELING—THE CUBE

### Figure I.

The diagram at the head of this paragraph is that of a cube. The sides of it are all alike in length and breadth. You often see objects of this shape — blocks of stone or parts of a building. Each face is a square, having equal sides and equal angles.

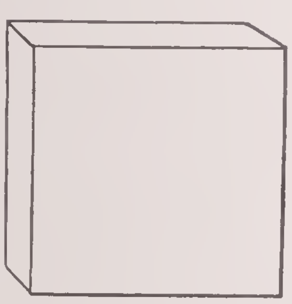


Fig. I

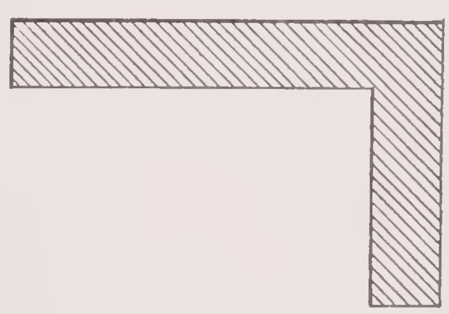


Fig. II

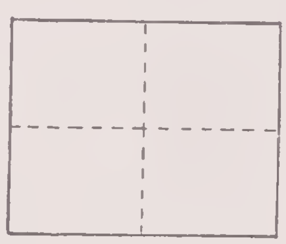


Fig. III

### Figure II.

The equal angles of these squares are called right angles, and when a carpenter wishes to draw such angles he uses what is called a "carpenter's square." You may make a carpenter's square of cardboard as follows: Take a sheet of stiff paper, letter size, fold once with even edges; fold it again, evenly across the first fold. When you open it out you will see that there are two straight lines crossing each other from edge to edge. These lines form four right angles. Fold the paper twice again, and on unfolding it you will find a carpenter's square, traced by the folds down one side and across one end of the sheet.

### Figure III.

Along the edge of your carpenter's square make a copy of the rule given in your measures of length, metric or English as you desire.

## HOW TO MAKE THE MODEL OF A CUBE

FIGURE IV.

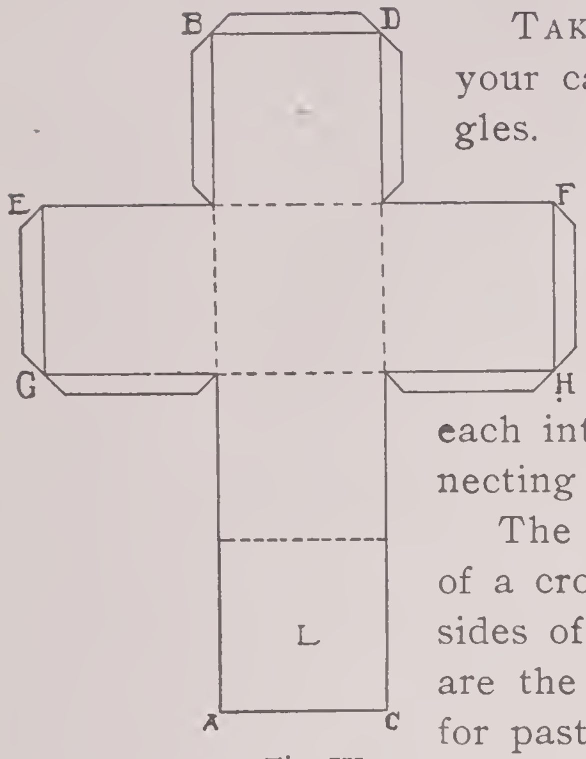


Fig. IV

TAKE a piece of cardboard, 8½ x 6½ inches. By means of your carpenter's square see that all the angles are right angles. Take a point A, 2¼ inches from the left edge and draw the line AB perpendicular to the bottom of the paper. Do it so as to have the point B 2¼ inches from the left edge. Take a point C 2 inches from A, and draw CD, making D at 2 inches from B. You will find that the lines AB and CD are 8 inches long; divide each into four parts. Draw the lines BD and dotted lines connecting points of division.

The figure now consists of six squares arranged in the form of a cross. Change those parts of BA and DC which form the sides of the central square into dotted lines. The dotted lines are the lines of folding. Lapels must be left (as in Fig. IV.) for pasting the model together. These lapels are to go inside. In cutting out the model you will find it best to lay the cardboard on glass, and cut with a sharp knife. L in our diagram is the last side to be pasted.

*Horizontal Surfaces.* You may tell whether your polished table is horizontal or not, by placing upon it a ball of ivory or other smooth substance. If the ball stands still, the surface is horizontal or level. The water in a small lake is horizontal when at rest.

*Parallel Surfaces.* If you place your cube on a level table you will find that the base on which it rests is horizontal, while the top surface is also horizontal. These are called parallel faces or surfaces.

When carpenters want to know whether a floor or table is level or horizontal they test it by a spirit level, *i. e.*, a straight bar of wood, in which is a glass tube, slightly arched and almost filled with alcohol. When this is laid on the floor a bubble appears in the exact center of the tube—if the surface be horizontal.

*Vertical Planes.* Vertical means from the head down. A vertical line crosses a horizontal line at right angles. A vertical line is that taken by a pendulum at rest or by a cord hanging free with a weight at the end of it. This last is called a plumb line.

When the cube is placed on a horizontal surface, all the vertical lines of its sides will be found parallel with a plumb line, and therefore parallel with one another, and the surfaces of the sides between these lines, which are vertical planes, are also parallel.

*A Test of Geometric Equality.* Place a cube on a piece of paper and trace the outline of the base with a pencil. Turn it and trace the outline of all the other sides on the same spot. If the cube be true and the trac-

ing accurate, all these tracings will present the appearance of a single square outline.

*The Three Dimensions in Geometry.* The distance between the upper and the lower sides of a cube is called its thickness, height, or depth. When you look at the face fronting you and consider the distance of that face with the face parallel to it and farther from you, you call it length. When you measure the distance between the right and left lines of the face fronting you, you call it breadth or width. These dimensions are, of course, all equal in a cube.

FIGURE V.

*Areas.* Draw on a paper or blackboard a square with sides five inches long; divide each side into parts of one inch. Draw lines parallel with sides, connecting these opposite points of division.

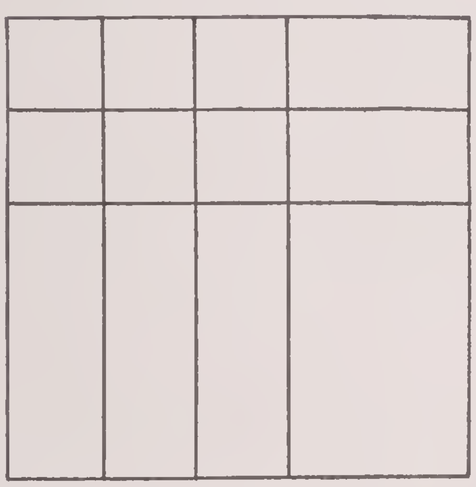


Fig. V

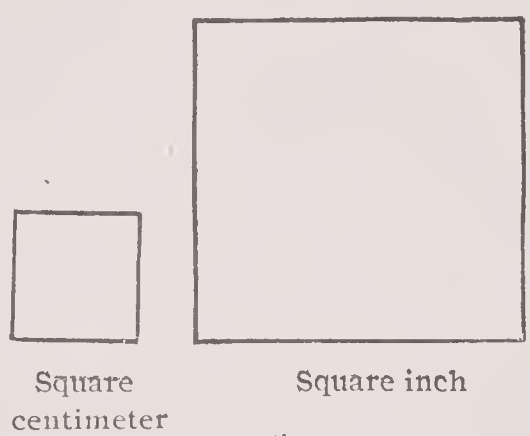



Fig. VI

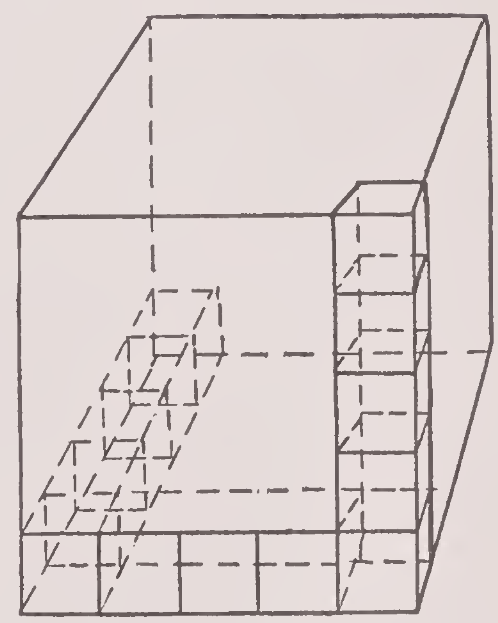


Fig. VII

FIGURE VI.

Draw a square with sides three inches long, and one with a square of four inches, and divide the sides of each in parts of one inch; connect points of division, as in the previous square.

The squares will present somewhat the appearance of checker-boards, and since each of the smaller squares has four sides, each one inch long, each is a square inch and the larger square containing them is said to contain so many square inches. Figure VI. shows the relative sizes of a square inch and a square centimeter.

FIGURE VII.

In the same way may be measured the solid contents or volume of a cube. If your cube had each of its edges divided into five equal parts, you could slice it off into five layers; each of these layers could again be cut up into twenty-five little cubes, called cubic inches, so that the large cube would be shown to contain 125 cubic inches, which we call the contents or volume of the cube.

## A PARALLELOPIPED

### Figure VIII.

(1) The above diagram represents a parallelopiped, *i. e.*, a figure with smooth parallel surfaces. The six surfaces are not equal, and this is the chief difference between this figure and a cube. Four are longer than the other two and each of these four is called in geometry a rectangle. Most buildings have some of their parts built in this form.

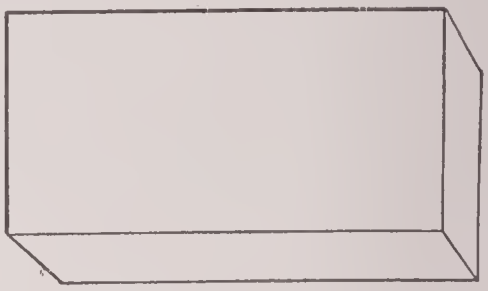


Fig. VIII

### Figure IX.

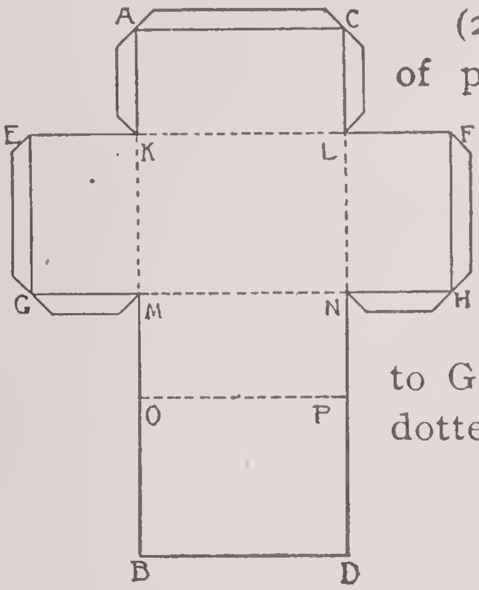



Fig. IX

(2) To make a model of the parallelopiped, take a sheet of paper 10¼x8½ inches. Make AB and CD 10 inches long, and the interval AC between them 4 inches. Then divide them as follows: 2 inches down from A and C to K and L, 3 inches from K and L to M and N, 2 inches from M and N to C and P. Then lengthen out two inches on each side of KL to E and F, and MN to G and H. Draw EG and FH. Fold as before on the dotted lines and paste.

### Figure X.

(5) *Quadrilaterals. Parallelograms.* The term Quadrilateral means four-sided, and is applied to figures of that form. A Parallelogram is a figure with parallel sides, the opposite sides being equal.

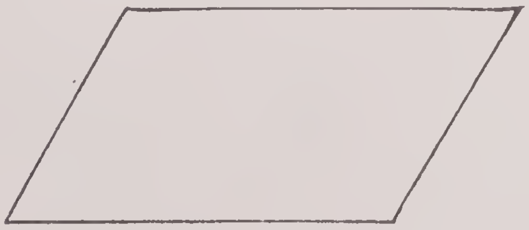


Fig. X

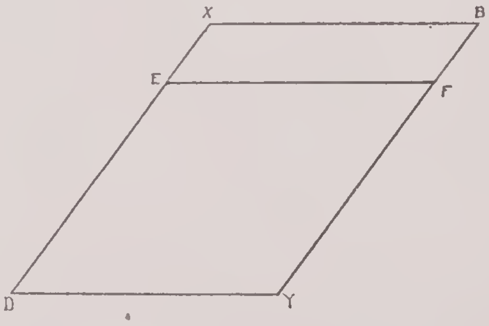



Fig. XI

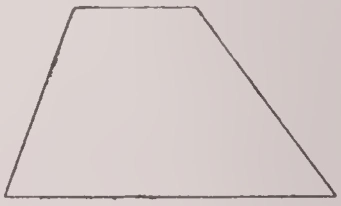


Fig. XII

### Figure XI.

*The Rhombus* is a parallelogram the sides of which are all equal, but its angles are not right angles.

### Figure XII.

The *Trapezoid* is a four-sided figure of which only two sides are parallel.

### Figure XIII.

Of four-sided figures the *Trapezium* has none of its sides equal.

The meeting of surfaces or edges of two bodies forms a line, and, although a line has only one dimension in geometry (length without breadth), is represented by the mark of a pencil or a pen. A straight line is formed when two plane or even surfaces meet, thus, when two cubes are set closely together they form a line, vertical when they are set side by side, horizontal when one is set upon another.

A straight line is the shortest distance between two points.

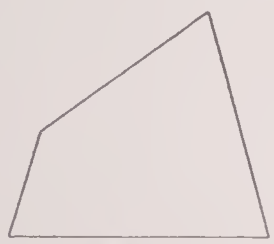


Fig. XIII

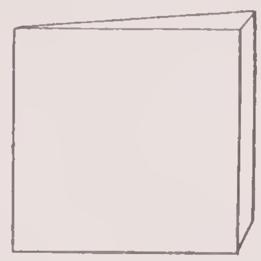


Fig. XIV

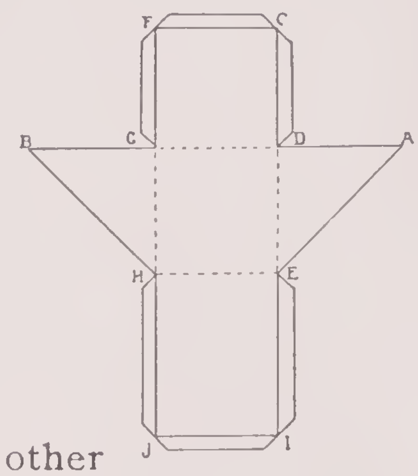



Fig. XV

### Figure XIV. The Prism

A *Prism* is, as its name implies, a part of some other figure; something "sawed off," a cube. Two sides are square, one a rectangle, the fourth a triangle.

### Figure XV.

To make a model of the triangle prism we take a sheet of paper 7¼ x 6 inches. AB is made 6 inches long and is divided into three equal parts, BG, GD, and DA.

CE and FH are 4 inches long. They cross AB vertically at D and C, where they are bisected, *i. e.*, divided into equal parts. AE and BH are next drawn, and CE and FH prolonged to make EI and HJ equal AE and BH. The diagram is completed by CF and IJ.

Prisms are of infinite variety; but they all agree in having two faces equal and parallel, and the others parallelograms.

The bases of the prisms are, as we have seen, triangles, and of these latter there are many kinds; *viz*:

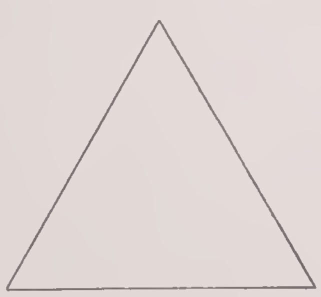


Fig. XVI

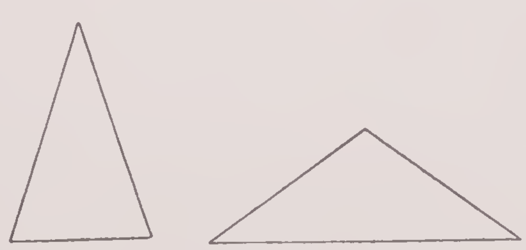


Fig. XVII

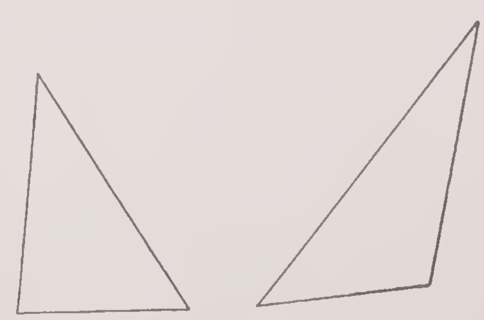


Fig. XVIII

### Figure XVI.

The Equilateral (equal-sided) triangle is so called from its shape.

### Figure XVII.

The triangle called Isosceles, *i. e.*, having equal legs, has two of its sides equal.

### Figure XVIII.

The Scalene, "Crook legged," triangle has all of its sides unequal.

### Figure XIX.

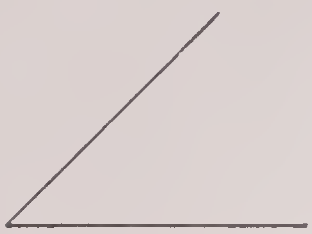


Fig. XIX

It will be noticed that an angle is formed by the meeting of two lines at one point. The hands of a clock make angles of all kinds, for sometimes they are close together, sometimes stand perpendicular to each other, and sometimes form a very wide angle, as when the small hand is at twelve and the large hand at twenty or twenty-seven minutes past twelve.

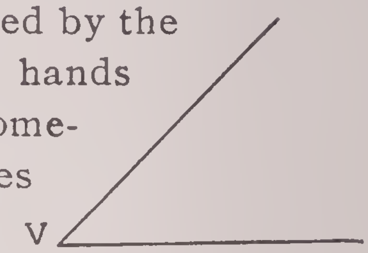


Fig. XX

### Figure XX.

The point where the two lines meet in the center of the clock-face is called the vertex of the angle.

### Figure XXI.

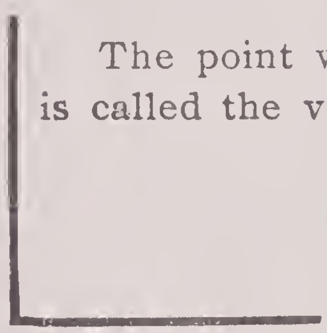
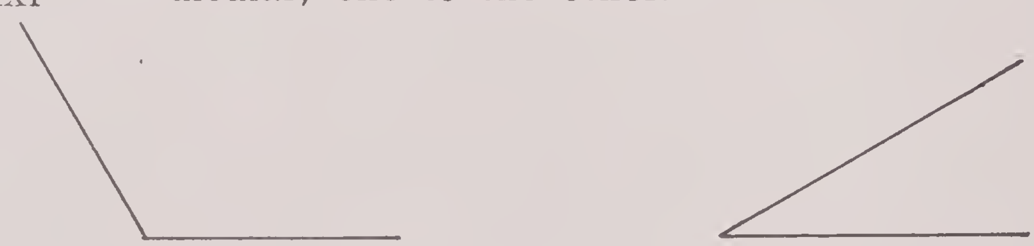


Fig. XXI

A Right angle is formed when two lines are perpendicular, one to the other.


An Obtuse Angle Fig. XXII An Acute Angle

### Figure XXII.

An Acute, or sharp angle is less than, or sharper than, a right angle. An Obtuse angle is greater, or blunter, than a right angle.

### Figure XXIII.

*The Truncated Prism* is one from which a part has been cut off by a plane inclined to the base.

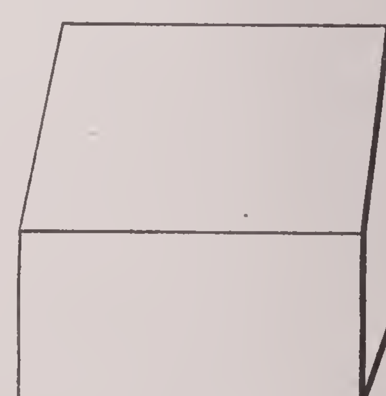


Fig. XXIII

### Figure XXIV.

To make an outline model of this form take a sheet of paper 7½ x 6½ inches. Our diagram XXIV. shows the construction. A, B, C, and D are squares

with sides 1 inch long. From the two upper corners of A are drawn lines to points O and F, which cut into two equal parts the sides, GH, and NQ, respectively. E is a rectangle with the longer edges equal to the lines OI or LF.

This gives an outline model for drawing.

Figure XXV. shows the mode of construction for a model to be cut and pasted. The dimensions and mode of construction are the same as in Figure XXIV., but the lapels are added to allow for pasting.

The base of the Truncated prism is the base of the prism of which it was a part.

The face formed by the cutting plane is called the *inclinea section.* The other faces are called *lateral* or *side faces.*

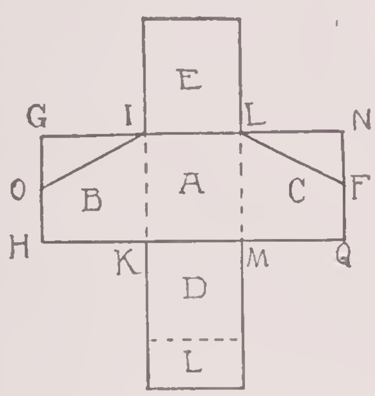



Fig. XXIV

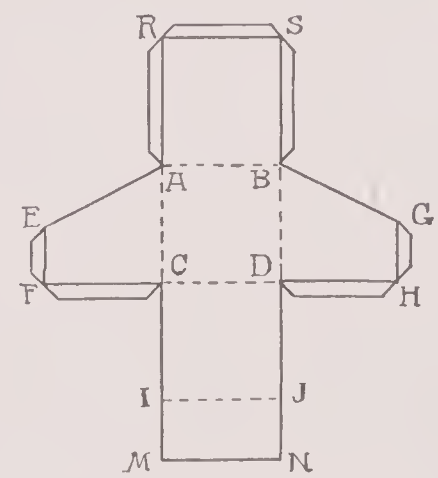



Fig. XXV

FIGURE XXVI.

*A Pyramid* (Fig. XXVI.) has all its triangular sides meet at the top or apex. The base is of many forms.

To form the model of a pyramid take paper 6½ x 6½ inches. Draw a square with sides 2 inches long, and bisect these sides at M, N, R, and S. Then draw the perpendicular lines MX, NY, RZ, and SW, each 2¼ inches long. Draw XA, XB, YB, YO, ZO, ZC, WC, WA — Figures XXVII., XXVIII.

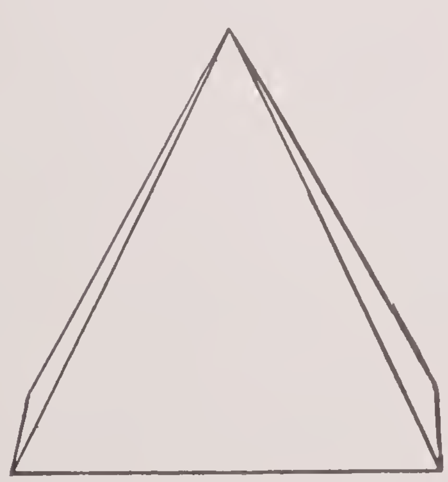


Fig. XXVI

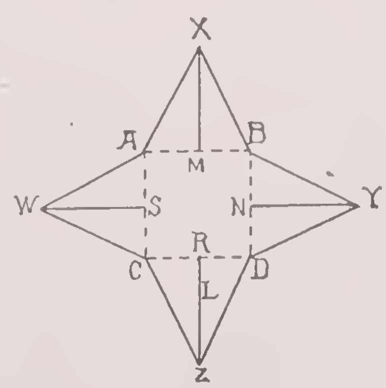



Fig. XXVII

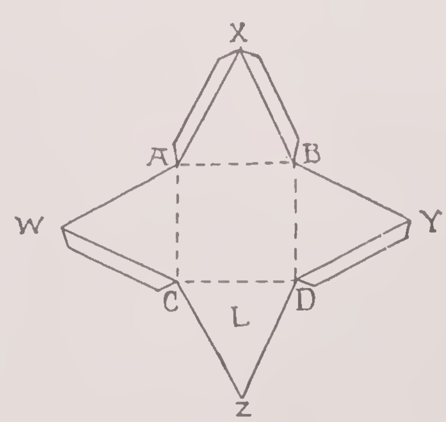



Fig. XXVIII

FIGURE XXIX.

A Triangular Pyramid has three faces or sides and a triangular base as shown in Figure XXIX.

### Figure XXX.

To form the model of a triangular pyramid, draw an equilateral triangle ABC, 6 inches on a side. Bisect each of the sides, and join the points of bisection by dotted lines. This forms four equal equilateral triangles. On cutting out, make allowance for the lapels. Fold on dotted lines and paste.

### Figure XXXI.

A Pentagonal Pyramid is one which has five triangular faces or sides and a five-sided base.

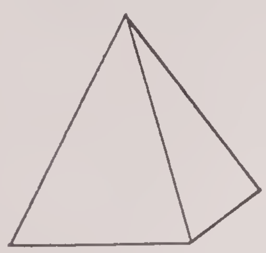


Fig. XXIX

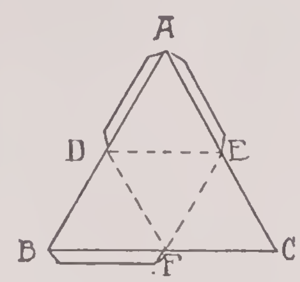



Fig. XXX

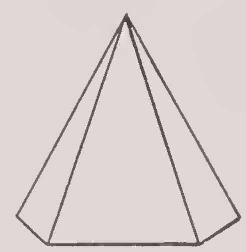


Fig. XXXI

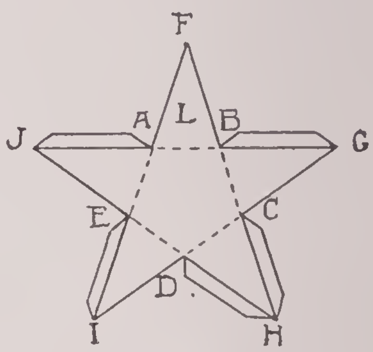



Fig. XXXII

### Figure XXXII.

*A Pentagonal Pyramid* is modeled on paper 6 x 6 inches, and the diagram (Fig. XXXII.) explains its general construction.

Draw AB; at A draw AE making the angle BAE 108 degrees.

At B draw BC making the angle ABC 108 degrees.

Join CD; at E draw ED making the angle AED 108 degrees.

Produce the lines AB, BC, CD, DE, EA, until they form the pentagonal star FGHIJ. Provide for the lapels, as shown in the figure. Cut and paste.

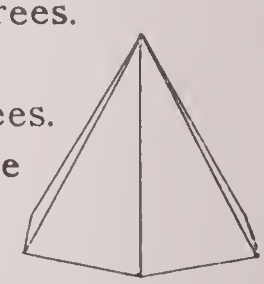


Fig. XXXIII

### Figure XXXIII.

A Hexagonal Pyramid is one which has six triangular faces or sides and a six-sided base.

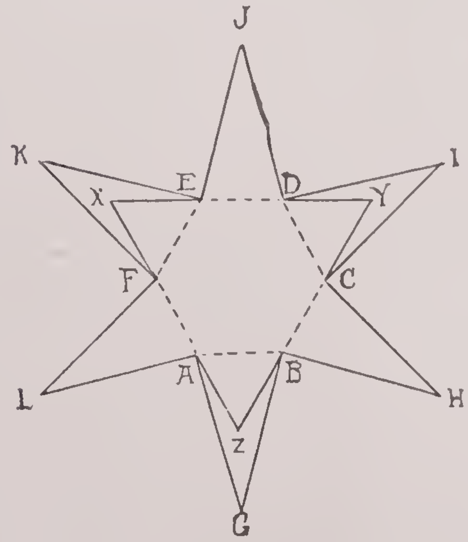



Fig. XXXIV

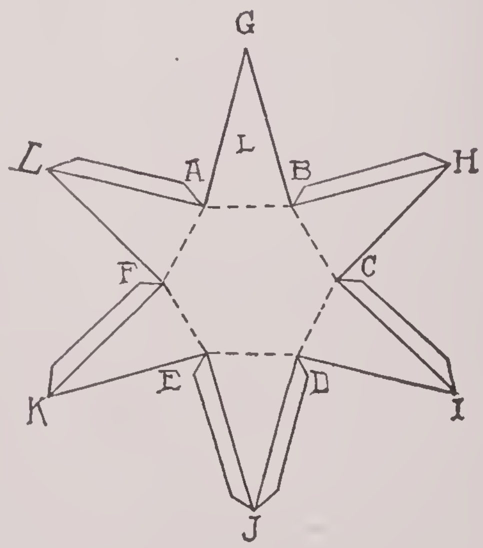



Fig. XXXV

### Figure XXXIV.

*A Hexagonal Pyramid* requires paper 6½ x 6½ inches.

Draw the equilateral triangle (Fig. XXXIV.) XYZ, with sides 4½ inches in length.

Divide each side in three equal parts at A, B, C, D, E, and F. Join the points EF, DC, AB, thus completing the hexagon.

Upon each of the hexagonal sides construct an isosceles triangle, each vertex being 78 degrees.

Unite these vertices. This gives an outline model for drawing.

Figure XXXV. shows the mode of construction for a model to be cut and pasted. The dimensions and mode of construction are the same as in Figure XXXIV., but the lapels are added to allow for pasting.

## Figure XXXVI.

*The Frustum of a Pyramid.* Frustum means « bit » or « piece, » and when a pyramid has its apex, or peak, cut off deep down, a frustum of a pyramid is left.

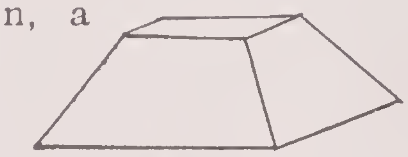


Fig. XXXVI

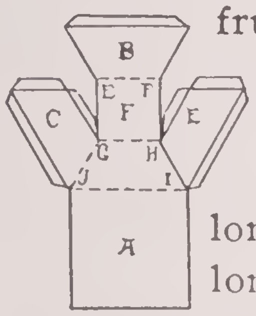



Fig. XXXVII

To model this, take paper 5½ x 4 inches.

In Figure XXXVII., A is a square, with sides 2 inches long. B, C, and E are trapezoids; one side of each is 2 inches long, the other sides are each 1 inch long. The angles at the end of the corners are all 60 degrees.

F is a square with sides 1 inch long. The lines of folding are EF, GH, GJ, JI, IH.

## Figure XXXVIII.

*A Truncated Pyramid* is a pyramid cut down by a plane not parallel to the base.

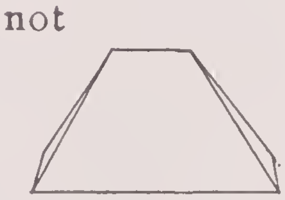


Fig. XXXVIII

To construct a model of the truncated pyramid paper is required 6½ x 5½ inches.

In Figure XL., A is a square, with sides 3 inches long; on each side erect an equilateral triangle, *i. e.*, with angles of 60 degrees.

B is a trapezoid formed by joining two points in the sides of the triangle at 2 inches from the base. D and E are trapeziums formed by joining two points on the sides of each triangle, one at 1 inch the other at 2 inches distant from the base.

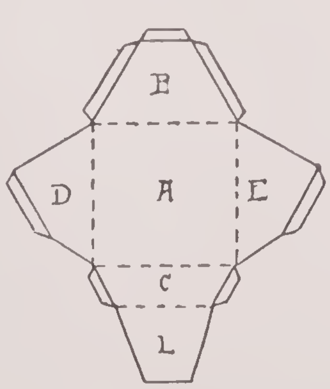



Fig. XXXIX

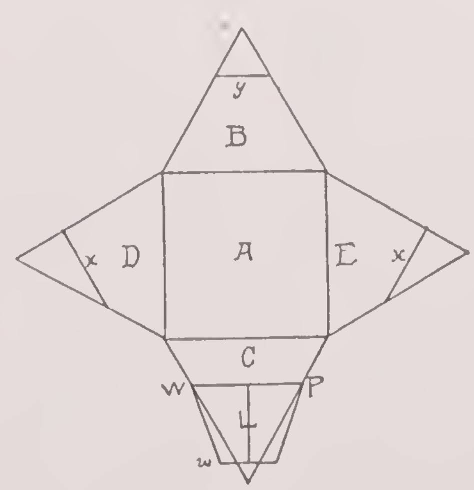



Fig. XL

C is a trapezoid formed by joining two points, W and P, for the sides of the last triangle, each at 1 inch from the base.

L is a trapezoid formed by drawing a line to the apex of the triangle perpendicular to WP, at 1⅝ inches distance from the base of this line; let it bisect a line 1 inch long drawn parallel to WP. Fold on the dotted lines in Figure XXXIX.

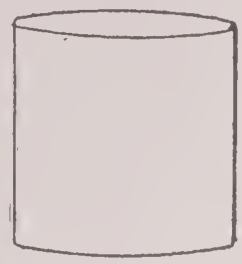


Fig. XLI

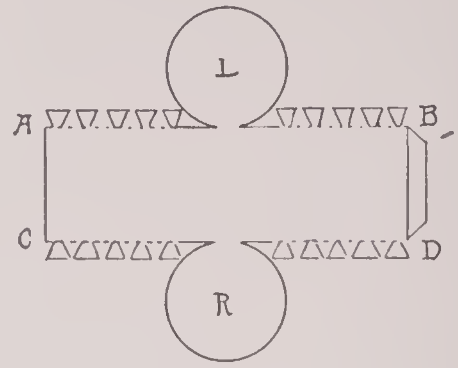



Fig. XLII

FIGURE XLI.

*A Cylinder*, literally "roller," is a body with three surfaces, two of them being parallel circles; the sides curved.

To construct the model of a cylinder we use paper 6½ x 6 inches. Figure XLII.

The rectangle ABCD, is 6 9-32 x 2 inches.

Draw circles L and R, at a radius of 1 inch, touching the lines AB and CD at the point of bisection.

First paste edges AC and BD. Then paste the other wedge-like lapels on the outside of the circular ends.

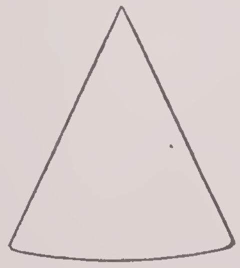


Fig. XLIII

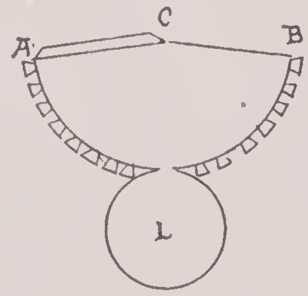



Fig. XLIV

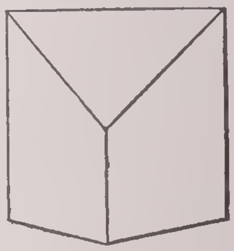


Fig. XLV

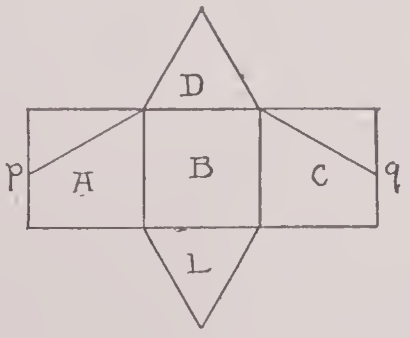



Fig. XLVI

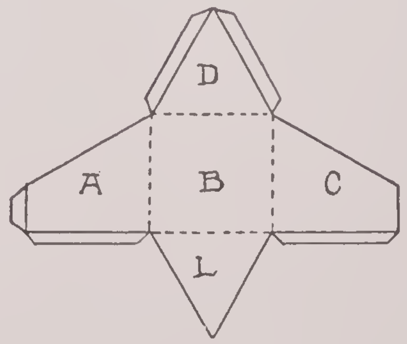



Fig. XLVII

FIGURE XLIII.

A cone, Figure XLIII. has two surfaces, one plane, *i. e.*, the circular base, the other curved. The curved surface begins at a peak and descends to the base as an isosceles triangle.

To construct the model take paper 5½ x 4 inches. Make an angle ACB of 160 degrees. With the vertex C as center, draw the arc AB at a radius

of 2¼ inches. With L as center draw, at a radius of 1 inch, the circle L, just touching the arc. Unite as in previous example. Figure XLIV.

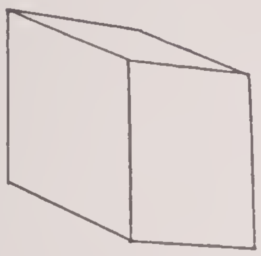


Fig. XLVIII

The following figures are various polyhedrons, the name usually given to solid objects having plane faces. To construct models of these figures is more difficult than the construction of preceding examples.

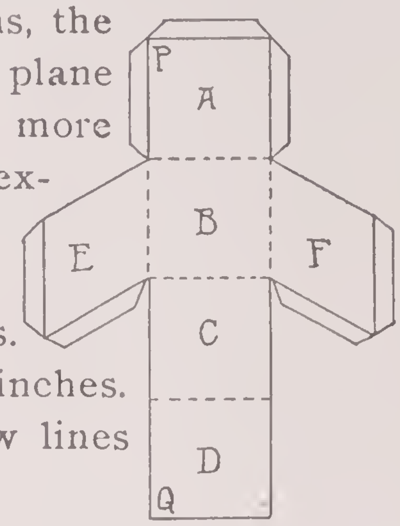



Fig. XLIX

*A Triangular Truncated Prism* (Fig. XLV.) will need for its construction a sheet of paper 6½ x 6 inches.

In Figure XLVI., A, B, and C are equal squares of 2 inches. Bisect the outer sides of A and C at the point P and Q; draw lines from each of these points to the upper corners of B.

Erect on the upper side of B a triangle whose apex is an angle of 50 degrees.

L is an equilateral triangle — 60 degrees; join on the dotted lines; Figure XLVII.

*A Quadrangular Prism* (Fig. XLVIII.) requires for the construction of its model a sheet of paper 8¼ x 6 inches.

Four squares, A, B, C, and D are arranged on the same perpendicular.

Construct on each outer side of the square B, two equal Rhombuses with angles 60 degrees, and 120 degrees — and sides 2 inches long.

Unite on dotted lines.

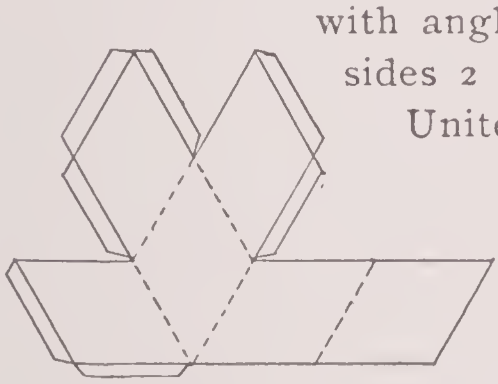


Fig. LI

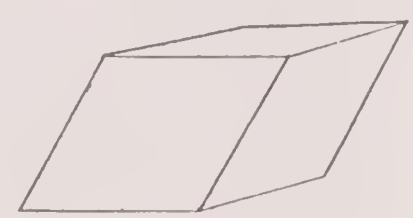


Fig. L

FIGURE L. — A RHOMBIC PRISM

On paper 8 x 5½ inches, draw six rhombuses arranged as in Figure LI, and unite by bending on the dotted lines.

FIGURE LII.

*The Regular Octahedron, i. e.*, the figure with eight faces.

The diagram (Fig. LIII.) will require paper 7½ x 6 inches, consists of eight equilateral triangles, or two equilateral triangles, with sides 4 inches long, and the model is formed by bending on dotted lines, and joining the edges.

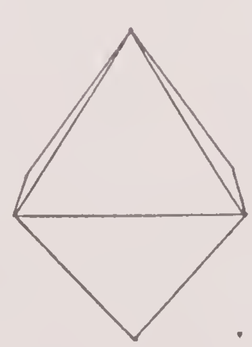


Fig. LII

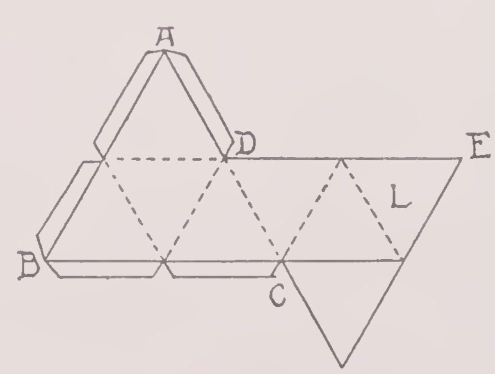



Fig. LIII

FIGURE LIV.

*The Regular Icosahedron, i. e.*, the figure with twenty faces, which requires for its diagram a sheet of paper 6½ x 3 inches, is constructed as in Figure LVI.

ABCD is a parallelogram with angles 60 degrees, and 120 degrees — with sides 5 inches and 3 inches long. Each side is divided by points into parts of 1 inch. These points are joined by parallel lines, forming thirty equilateral triangles, which are cut down to twenty as in diagram LV.

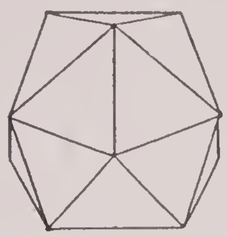


Fig. LIV

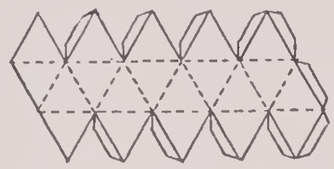


Fig. LV

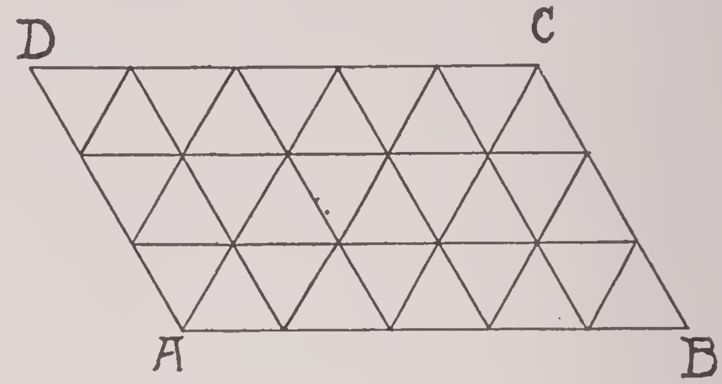



Fig. LVI

FIGURE LVII.

*The Regular Dodecahedron, i. e.*, twelve-sided figure — Figure LVII.

Paper for diagram must be 7 x 4 inches.

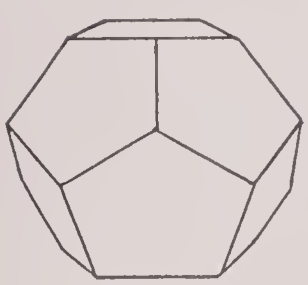


Fig. LVII

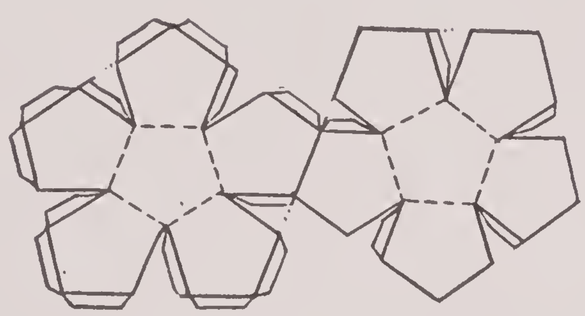


Fig. LVIII

The construction is seen from Figure LIX. — ABCDE is a regular pentagon, each angle being 108 degrees and each side being 2 inches long. The opposite angles of the figure are joined by the lines AD, AC, BE, BD, CE, — a small encentral pentagon is thus formed.

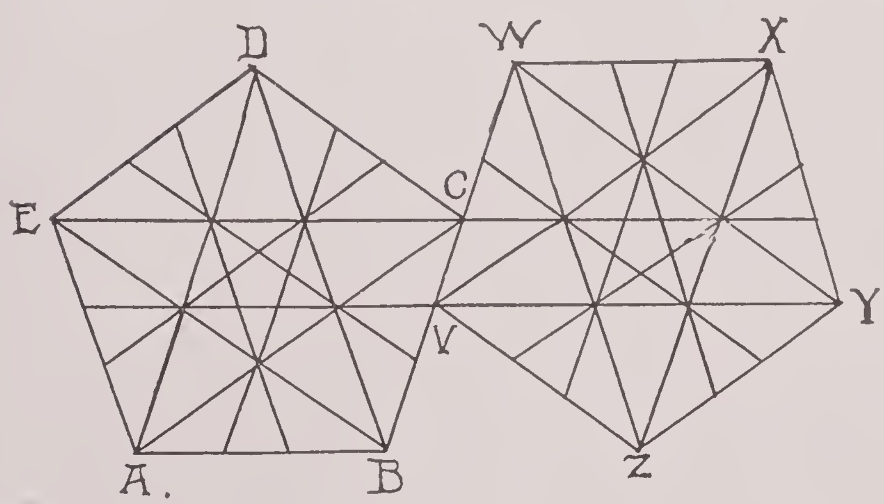



Fig. LIX

Draw the diagonals of the smaller pentagon, and prolong to the sides of the larger one — thus forming five more pentagons.

Next, draw the regular pentagon VWXYZ, VC being the vertical side of one of the smaller pentagons, prolonged so that VW may be equal to BC. Then draw diagonals, as before. Cut out and fold as in Figure LVIII.

FIGURE LX.

*A Pentagonal Prism* (Fig. LX.) may be represented in diagram on a sheet of paper 5 x 5 inches. (Fig. LXI.)

The faces consist of rectangles and regular pentagons.

The rectangles have sides 2 inches and 1 inch long.

The pentagons have sides 1 inch long, and angles of 108 degrees.

### FIGURE LXII.

*Crystal of Spinel.* The diagram will need paper 7½ x 6½ inches.

ABC (Fig. LXIII.) is an equilateral triangle with sides 7 inches long.

Divide each side into seven parts of 1 inch each. Draw lines parallel with sides of the figure connecting the points of division, thus forming smaller equilateral triangles.

In Figure LXIV. is shown how these triangles lend themselves to the formation of the exact diagram of the crystal.

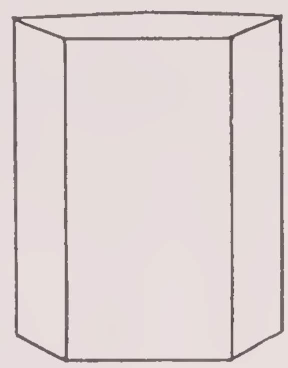


Fig. LX

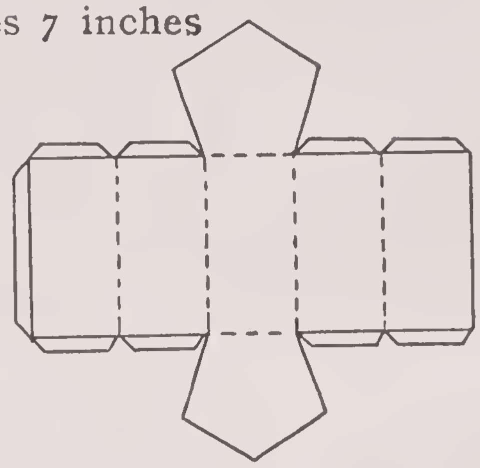


Fig. LXI

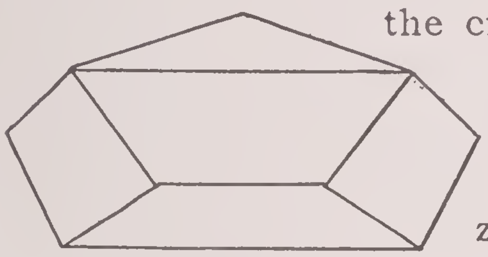


Fig. LXII

The face consists of equilateral triangles with sides 2 inches long; rhombuses with angles 60 and 120 degrees, and sides 1 inch, and trapezoids with angles 60 and 120 degrees, and edges 2 inches and 1 inch long.

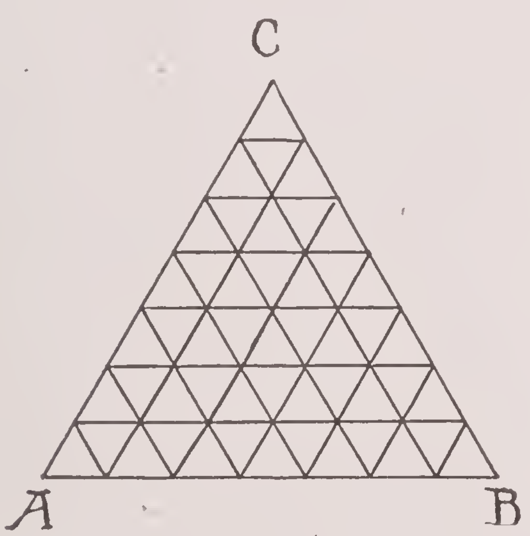


Fig. LXIII

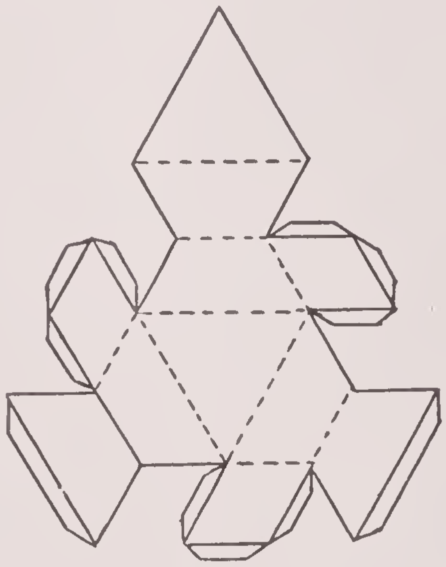


Fig. LXIV

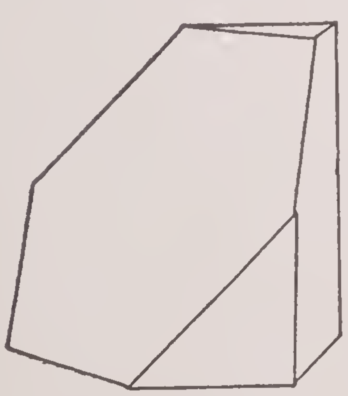


Fig. LXV

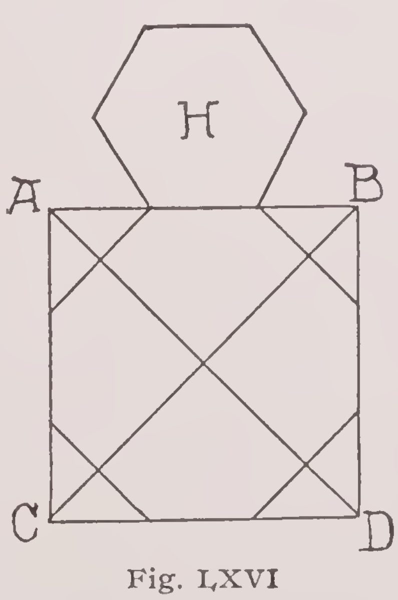


Fig. LXVI

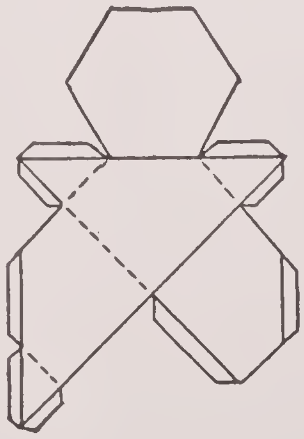


Fig. LXVII

### FIGURE LXV.

*Crystal of Copper.* (Fig. LXV.) The diagram will need paper 5 x 3½ inches.

In Figure LXVI, ABCD is a square with sides 3 inches long. Divide each side into three parts of 1 inch. The parallel lines are drawn from corner to corner, and between corresponding points of division.

Construct a regular hexagon on the middle division of any side of the square.

Cut out the paper until Figure LXVI. is changed to Figure LXVII.

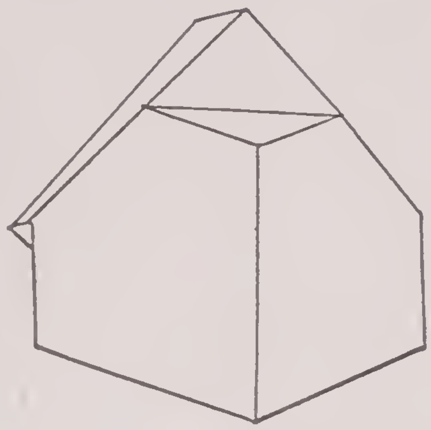


Fig. LXVIII

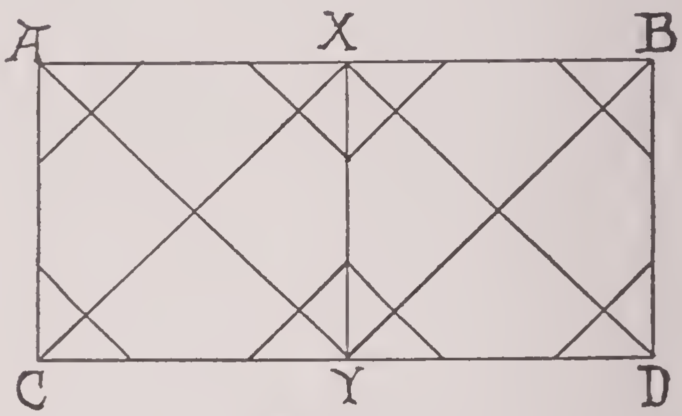



Fig. LXIX

FIGURE LXVIII.

*Twin Crystal of Calcite.* The diagram requires a sheet of paper 6½ x 3½ inches.

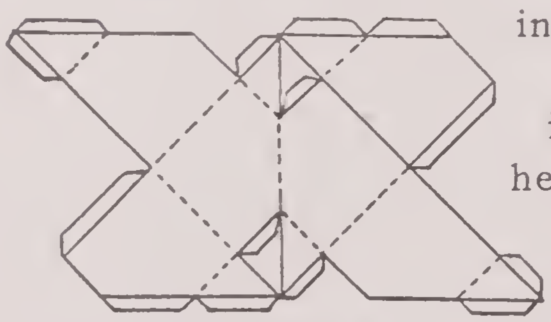


Fig LXX

The construction of Figure LXIX. is the same as in the preceding example, with the omission of the hexagon. ABCD is a rectangle with sides 6 inches and 3 inches, divided into squares by the line XY.

Treat in the same way as in preceding model.

Change Figure LXIX. into Figure LXX. by cutting. Fold on dotted lines and paste.

# MECHANICAL DRAWING

THE object of all forms of drawing, whether it be the picturing of scenes from nature, the portrayal of human form and expression, or merely the production of a plan to guide a workman in his work, is the representation of objects by means of lines, or lines and shades, drawn on plain surfaces. Drawing done with the free hand, without a guide for the pencil or brush, is known as "free-hand" or artistic drawing. Its special object is the production of drawings that shall please the eye and shall show objects, not as they actually are, but as they appear to be. Mechanical drawing, on the other hand, is drawing done by the aid of instruments, to insure the greatest accuracy possible, and its purpose is to represent objects as they are — not as they appear to be.

Much, in fact almost all, mechanical drawing is intended to guide workmen in the execution of work of many different kinds. The construction of all machinery, the erection of houses and bridges, and the building of railways, are all facilitated, and in fact governed, by the use of mechanical drawings. In the construction of machinery, for example, the exact form and size of each part is indicated by mechanical drawings, from which the parts may be made with such accuracy that they may be fitted together without any alteration being required. The value of drawings in all forms of mechanical work needs no further illustration and the prime importance of accuracy in all mechanical drawing must be apparent. Mechanical drawing bears the same relation to all forms of Manual Training and mechanical work that the foundation does to a house, and consequently he who wishes to become a skilled mechanic must understand it thoroughly.

In the series of exercises presented in the following pages, an attempt has been made to present briefly the simplest and most necessary branches of mechanical drawing, in such a way that an instructor will not be necessary to enable the student to comprehend them. For these exercises the student should have the following:—

## INSTRUMENTS AND MATERIALS

Drawing-board.
T-Square.
Triangles.

Compasses.
Dividers.
Bow-pen and bow-pencil.
Drawing-pen.
Pencils.
Scale.
Protractor.
Thumb-tacks.
Rubber erasers and sponge rubber.
Paper.
Ink.

The drawing-board should be made of some soft wood — preferably white pine, well-seasoned, and straight-grained, and the grain should run lengthwise of the board. It should be free from knots, so that it will easily receive the thumb-tacks used to fasten down the paper. Its surface should be perfectly flat, in order that the paper will lie smooth and close to the board. The edges must be smooth and must form right angles with one another. To prevent the board from warping, it should have strips tongued into the ends, or battens fastened across the underside. If the latter are used, they should fall a little short of the edges of the board, so that if the board shrinks they will not protrude. A convenient size for the board is 16 x 21 inches. (Figs. 1 and 2.)

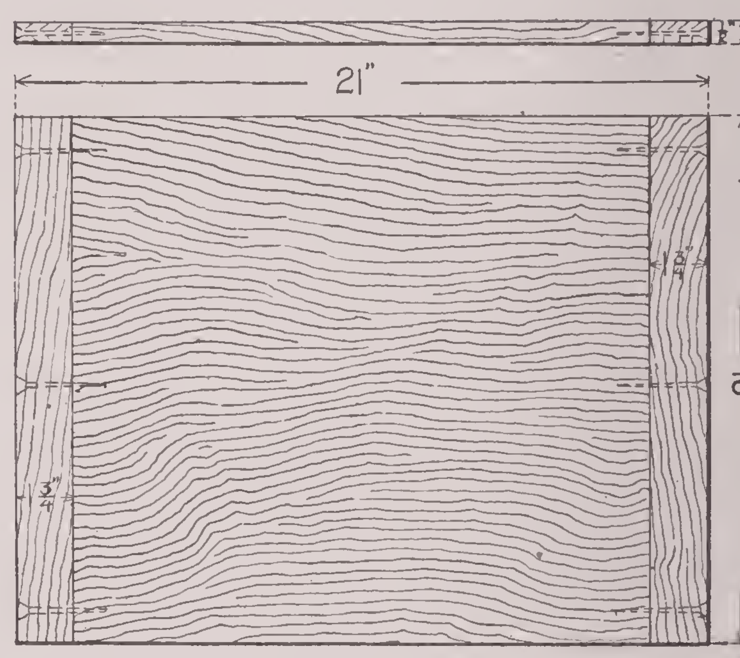


Fig. 1

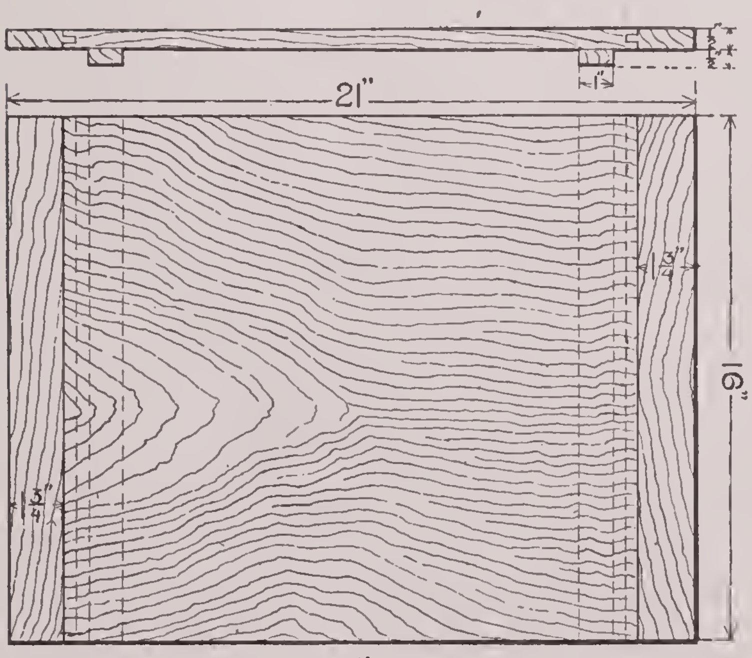


Fig. 2

The T-square may be made of wood, hard rubber, or steel, and should be of the simple pattern shown in Figure 3. The cheapest material is wood and for the use the T-square will receive in this course of lessons, that material will serve as well as any other. The T-square should be provided with a hole at the end of the long piece, or blade, for hanging it up, and when not in use it should always be suspended by the blade.

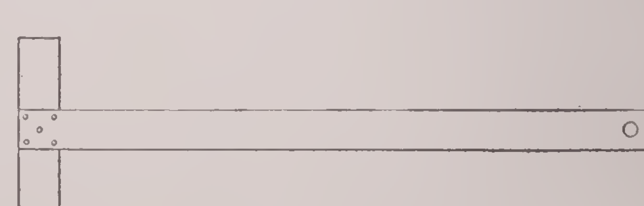


Fig. 3

The T-square is used for drawing horizontal straight lines. In using it the short piece, or head, is placed against the left-hand edge, of the drawing-board as shown in Figure 4, and the upper edge of the blade is brought very near to the point through which the line is to be drawn, so that the straight edge of the blade may be used as a guide for the pencil or drawing-pen. If the edge of the drawing-board is straight, as it should be, all lines drawn in this manner must necessarily be parallel.

Fig. 4

Only two triangles are required for this course, and these should be of the forms shown in Figure 5. It will be seen that both of these triangles are right-angled triangles, but that, while the acute angles of one are equal and of 45 degrees each, those of the other are unequal, one being an angle of 30 degrees, and the other 60 degrees. These triangles may be made of wood, hard rubber, celluloid, or other material. Celluloid is cheap and makes excellent triangles.

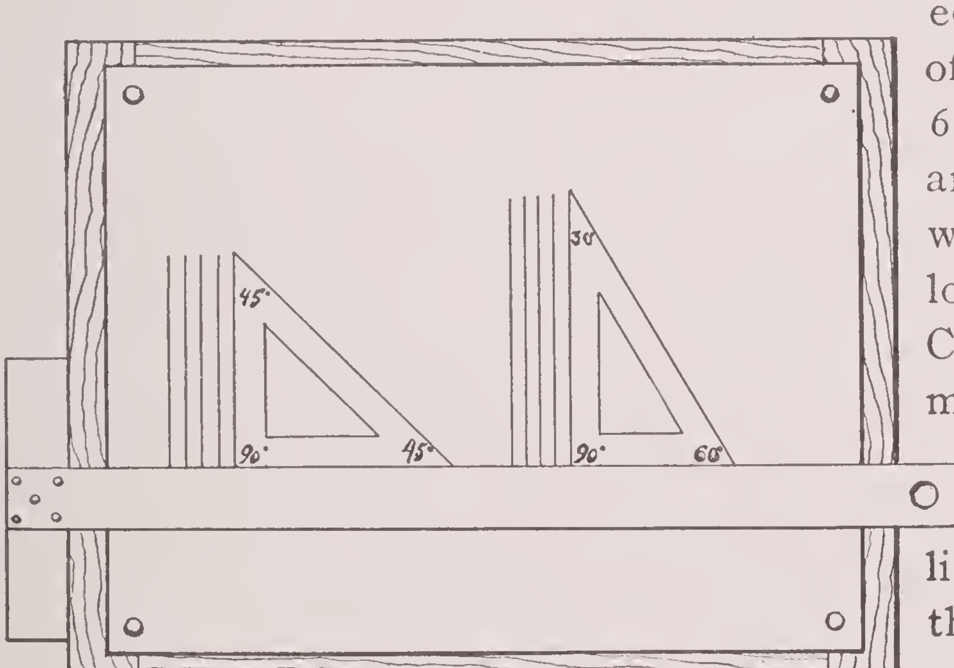



Fig. 5

Triangles are used in making all the straight lines in a drawing except the horizontal lines, which, as you have learned, are drawn with the T-square.

In drawing vertical lines, the T-square is placed in position for drawing horizontal lines, and a triangle is laid with one side against it and another forming a right angle with it, as shown in Figure 5. Both triangle and T-square must be held firmly but lightly with the left hand, so as to keep them from slipping, and the line should be drawn by means of a pencil or drawing-pen held in the right hand, and against the vertical edge of the triangle.

For drawing parallel lines that are neither horizontal nor vertical, the triangles are used, sometimes with the T-square and sometimes without it. When the lines required make angles of 30 degrees, 45 degrees, or 60 degrees, with the horizontal, they may be drawn by placing a triangle with

its longest side, or hypotenuse, in contact with the edge of the blade of the T-square, which is held in the manner described above, and by drawing along one of the shorter sides of the triangle. For drawing other parallel straight lines, the best and simplest way, when the lines are near together, is to place one side of a triangle on the given line, and lay the other triangle with one side in contact with the side of the former triangle, at right angles to the given line, holding it fast with the left hand; then move the first triangle along the side of the second. This is illustrated in Figure 6 in which *ab* represents the given line and *cd* the side of the triangle X, which is laid on the given line. Triangle Y is then placed with its long side in contact with the side *cf* of the triangle X. The triangle X is then slid along the triangle Y until the side *cd* is at the desired distance from the line *ab*, with which it remains parallel. When the side *cd* is in the desired position, both triangles are held firmly with the left hand, and with the right hand the pencil is drawn along the side *cd*. Triangle X is again slid along the side of triangle Y after a line has been drawn, and when the side *cd* is at the proper distance from the line just drawn, another is drawn in similar manner. This operation is repeated until the requisite number of lines has been drawn. If the triangle X should extend too far beyond the triangle Y after a number of lines has been drawn, the triangle X should be held stationary with the left hand and the triangle Y moved along the side of X, with the right hand, until it is in suitable position; then it should again be held firmly with the left hand and the drawing continued as before.

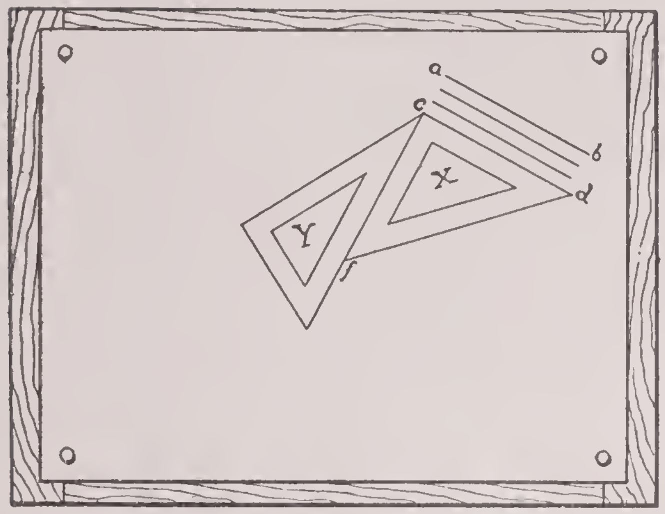


Fig. 6

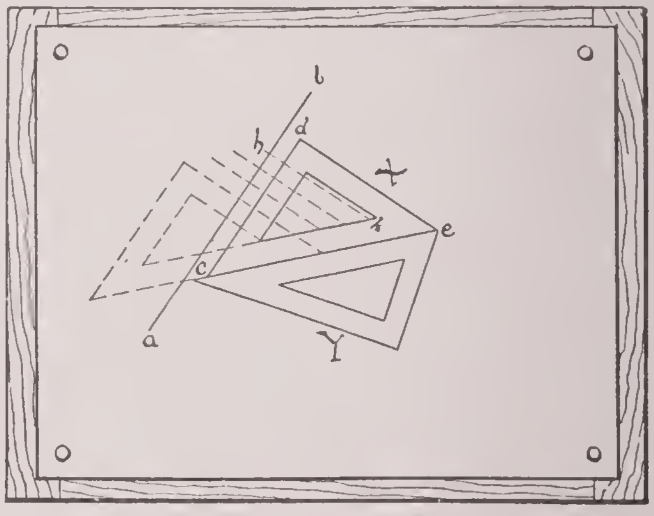


Fig. 7

The method employed for drawing lines perpendicular to a given line that is neither vertical nor horizontal, is very similar to that used in drawing lines parallel to a given line of that kind. In Figure 7 this is illustrated. The triangle X is first placed with the short side *cd* on the given line *ab*, and the triangle Y is then placed with its long side against the long side of the triangle X. The triangle X is then slid along the triangle Y as a guide, until the side *de* lies across the given line *ab*, making right angles with it. Both triangles are then held with the left hand and a line is drawn by passing the

pencil in the right hand along the side *de*. The successive lines are produced by sliding the triangle X along the long side of triangle Y, and passing the pencil along the side *de* as it reaches the successive points through which it is desired to draw the lines.

Next to the T-square and triangles, the compasses are probably more frequently used than any other instrument. They consist of two legs connected by a pivot at the top, and preferably the legs are jointed. Each leg is usually provided with a separable end, which has a reduced portion that fits a socket in the main part of the leg and is clamped therein by means of a small milled-head screw. The object of this is to make it possible by the substitution of different end-pieces to use the same compasses for drawing with lead or ink. The compasses always have one leg terminating in a fine steel point. In the more expensive instruments, this point is a separate bar of steel, which is held by means of a screw-clamp, and, hence, is easily adjusted in position, or removed when no longer serviceable. The other leg of the compasses may be fitted with a similar point at the tip, converting the instrument into dividers, of which more will be said in a later paragraph, but ordinarily it terminates in a drawing-pen or a clamp for holding lead.

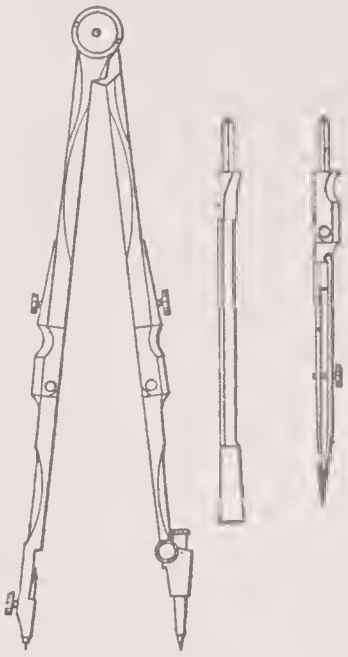


Fig. 8

The pivot joint connecting the two legs of the compasses is so constructed that it can be adjusted to make the opening and closing of the legs easy or difficult, and when the compasses are in use this joint should be so adjusted that the opening between the legs can be readily increased or decreased with the use of only one hand, but so that the pressure upon the instrument while in use will not cause the opening between the legs to vary. In setting the compasses, only one hand should be used, and the instrument should be grasped as shown in Figure 9. The advantage derived from setting the compasses in this way is that it leaves the other hand free to be used at the same time in other ways, and this frequently results in the saving of a considerable amount of time.

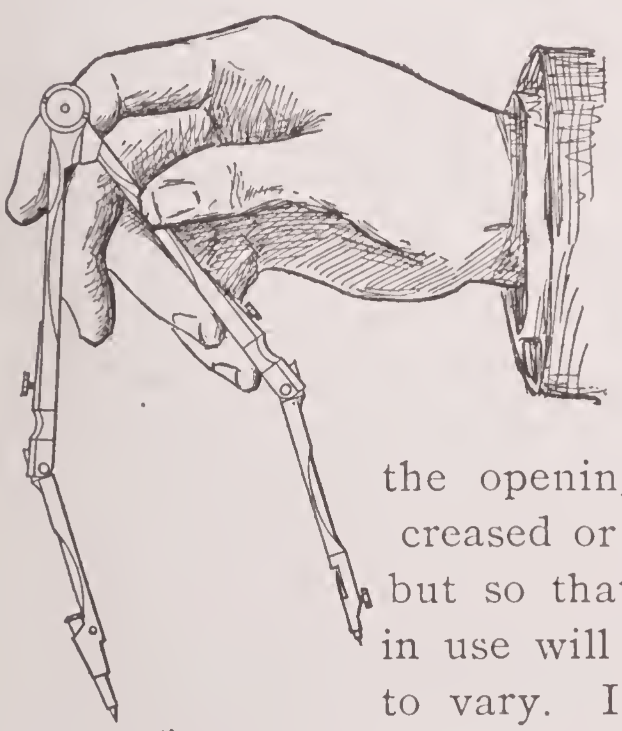


Fig. 9

When the compasses are in use, the legs should be as nearly vertical as possible to insure the best results, and for this reason the legs of good compasses are jointed. The lower parts of the legs may then be set nearly vertical, notwithstanding the spread of the upper

parts. After the compasses have been set at the desired opening, take them in your hand, as shown in Figure 9, and incline them until the underside of your hand rests upon the paper. In this way you can steady your hand so that you can bring the fine steel point of the compasses exactly to the right place on the drawing. After you have placed the needle-point of the compasses in the proper position, slip your hand up to the top of the instrument and hold it as represented in Figure 10, while drawing the desired circle or arc. In using the compasses, be careful to press lightly on them so as to avoid making large holes in the paper. Ordinarily the needle-point of the compasses is so sharp that no pressure upon it is required; but a little pressure upon the pen or pencil-point is necessary. Another point that you should bear in mind when you are drawing with the compasses, is to incline the top of the instrument a trifle in the direction in which it is moving.

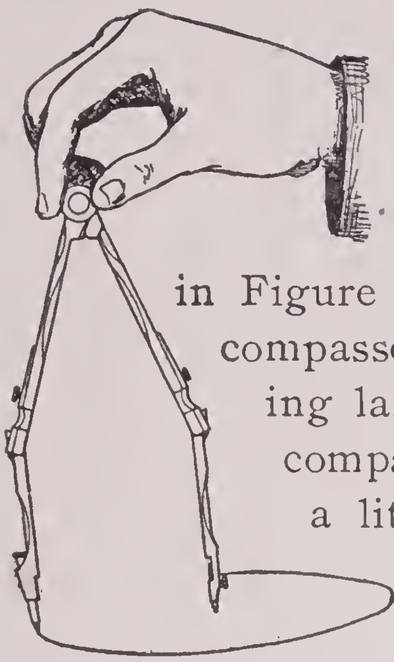


Fig. 10

The dividers may be an instrument entirely distinct from the compasses, or they may be formed from the compasses by replacing the pen or pencil-point with another needle-point. Any one who has much drawing to do will find it best to have dividers that are entirely separate from his compasses, for much time will otherwise be lost in changing the points in order to convert compasses into dividers, and *vice versâ*. Dividers of the pattern shown in Figure 11 are a very good form to use. The uses of dividers in mechanical drawing are found in laying off distances upon the paper and in dividing straight lines or circles into equal parts. When using them for the latter purpose you should hold them at the top between the thumb and forefinger, in the same way that you hold compasses; and step off the spaces by turning the instrument alternately to the right and left. If the line or circle does not divide exactly, vary the distance between the points of the dividers and try again. After several trials you will generally succeed in spacing the line or circle exactly. In using the dividers, you must exercise even greater care than in using compasses, to keep from pressing the divider points into the drawing-paper; for if the points enter the paper, you will find that it is impossible to space accurately, and the paper will be more or less defaced.

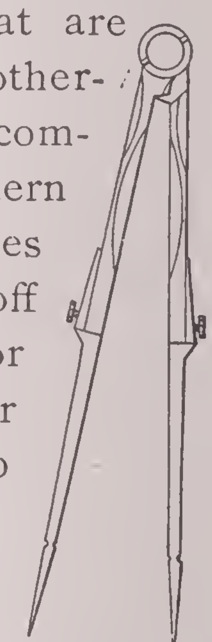


Fig. 11

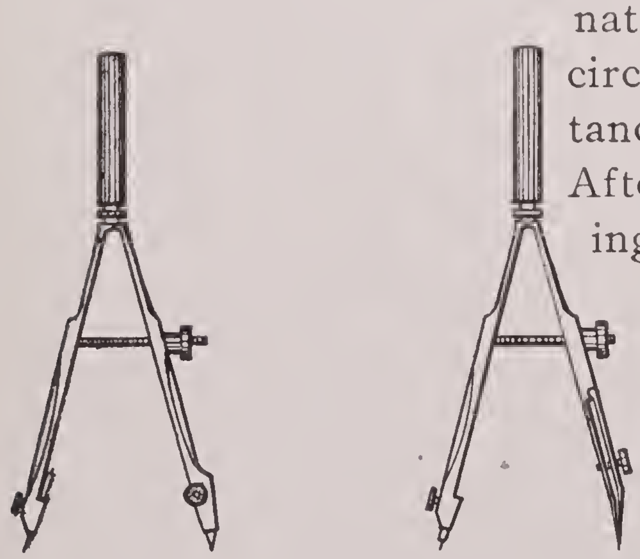


Fig. 12

The bow-pen and bow-pencil are instruments of convenience rather than of necessity. They serve especially well for describing small

circles and arcs, but, if you are careful, you can do the same work with the compasses. The bow-pen and bow-pencil are shown in Figure 12, and you will understand from the figure that in using either you should hold the handle at the top between the thumb and fore-finger.

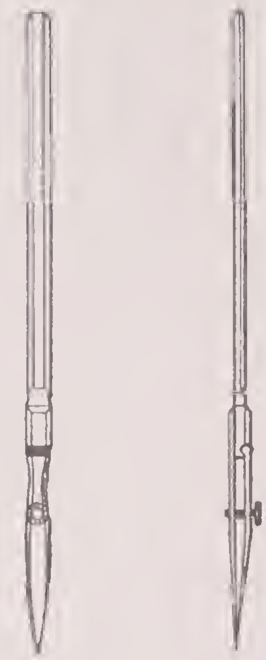


Fig. 13

The drawing-pen which is shown in Figure 13 is a very important instrument and you should learn how to use it skilfully and how to care for it properly, for failure in either will cause your drawing to have a poor appearance. A good drawing-pen has blades of exactly the same length, and its points are smooth and sharp, so that a fine line may be drawn with them. But, of course, they should not be sharp enough to cut the paper.

The drawing-pen is used for drawing all ink lines other than arcs or circles. It should be held as nearly perpendicular to the surface of the paper as possible. In order to keep the pen in the proper position the hand must take the position shown in Figures 14 and 15. At first this is not easy to do, and you will find that it is not always easy to make smooth lines. It is a very simple matter to incline the pen a little and get one of

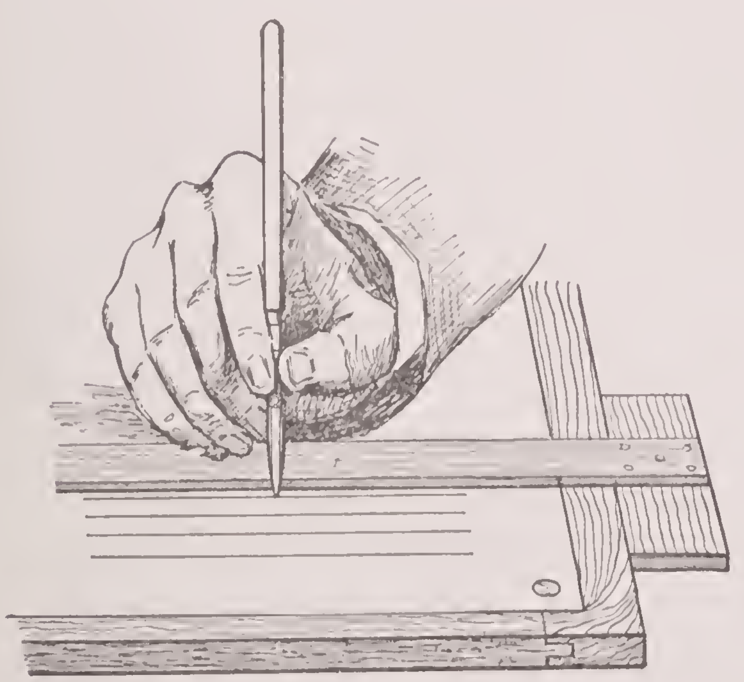


Fig. 14

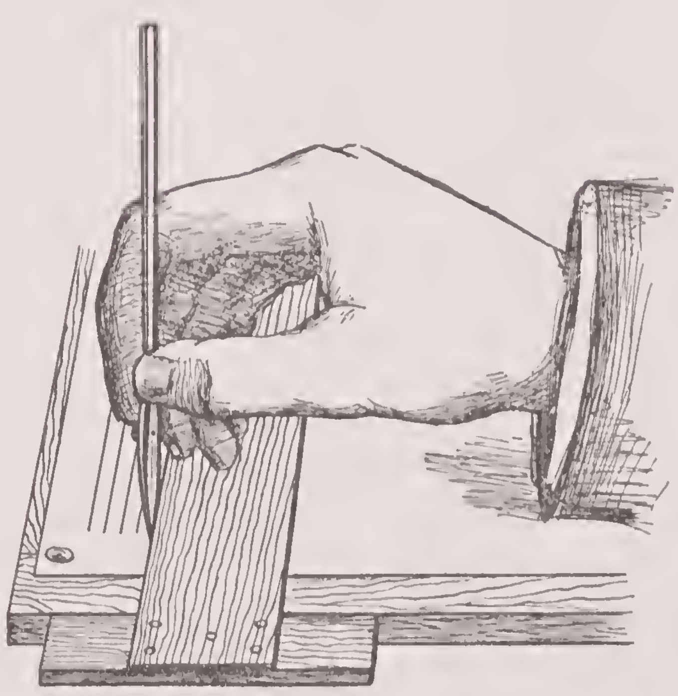


Fig. 15

the blades off the paper, and so cause the line to be ragged at those places where only one blade touches. When both blades rest on the paper, however, a pen that is in good condition will produce smooth, even lines. You will observe that in Figure 15 the hand is shown resting very lightly upon the blade of the T-square, and the drawing-pen is not pressed against the edge of the T-square. It is important that the pen should rest very lightly against the T-square which should serve merely as a guide, not as a support.

Much pressure against the edge of the T-square will cause it to slip, and the drawing will be injured, perhaps ruined.

The width of the line made by the drawing-pen is regulated by means of the screw connecting the blades of the pen. This is also true of the pen-point used in the compasses. When using either, you must be careful to keep the points clean if you want to produce clear, smooth lines. For this purpose, it is well to have a piece of cotton cloth or velvet at hand, and to draw the points of the pen over it from time to time, to remove any ink that has settled there and which may obstruct the flow from the pen to the paper. When the pen is laid down for some minutes, with ink on the blades, the screw should be loosened and the blades spread apart, to prevent the settling of the ink at the points; and when the pen is put away it should first be cleaned carefully, to prevent corrosion of its tips by the ink.

When a drawing-pen becomes dull and no longer makes fine lines, it must be sharpened by rubbing it on a close-grained oilstone. The first step in sharpening is to screw the blades of the pen together, and, holding the pen as you do in drawing, pass it back and forth over the stone, inclining the pen in the direction in which it moves. The object of this operation is to bring the blades of the pen to exactly the same length and to round them nicely at the point. In order to obtain the desired rounding, you will have to change the inclination of the pen constantly during each movement.

After the blades have been brought to the proper length they are, of course, duller than they were at first. To sharpen them, you should separate the blades by means of the screw, and rub one blade at a time to and fro in a straight line over the stone. You should hold the blade at an angle of about 15 degrees with the stone, and should give it a slight twisting motion while rubbing it. All the sharpening should be done on the outside of the blades, and the process must be kept up until the edges are fairly sharp and smooth, but not sharp enough to cut the paper. After the blades have been sharpened sufficiently, the inner surfaces may be rubbed very gently over the stone, to remove any burr or roughness that has been formed there in the sharpening process, and which may interfere with the flow of ink. The whole operation of sharpening must be done with great care, for it is very easy to spoil a pen by careless treatment.

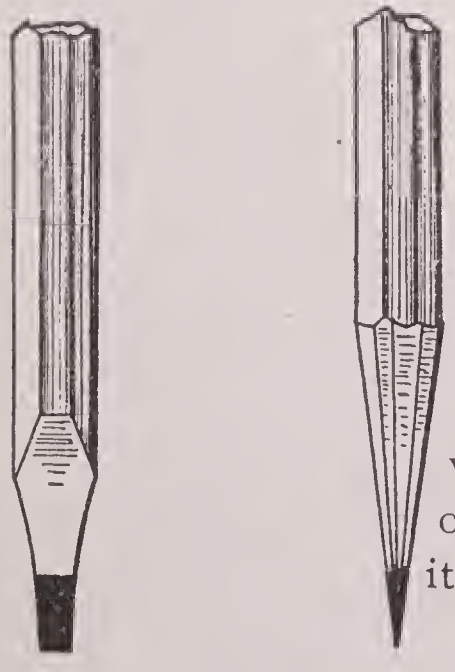


Fig. 16

The pencils used in mechanical drawing are of hard lead — about the HHHH grade. Lead of this grade should also be used in the lead-holding compasses, and the lead of both pencils and compasses should be trimmed to a wedge-like point as shown

in Figure 16. The advantage of a point of this kind over a conical point is that it does not wear away so fast. In sharpening the lead of a pencil, or that for use in the compasses, it is well to grind it to desired form by rubbing it against a fine file, or a piece of fine emery-cloth, fastened on a flat piece of wood.

The flat, chisel-shaped point is in almost universal use for drawing lines, but the draftsman sometimes finds use for a very sharp point of the ordinary conical form, in marking points and laying off measurements upon a drawing. For this reason, it is a good plan to sharpen one end of the drawing-pencil to a flat, wedge-like point, in the manner described, and to sharpen the other to a fine, conical point, by first cutting the wood and lead approximately into the form desired and then finishing by rubbing the lead on fine emery-cloth, or a file.

For obtaining the measurements to be used on your drawings, you will need a scale of the form illustrated in Figure 17. This is one of the simple forms of scale, but it lies flat on the drawing, and the beveled edges serve to bring the lines of division close to the paper, so that the drawing may be accurately measured or distances laid off correctly. The use of the scale cannot be made clear to you until you reach the exercises in which it is necessary to use them.

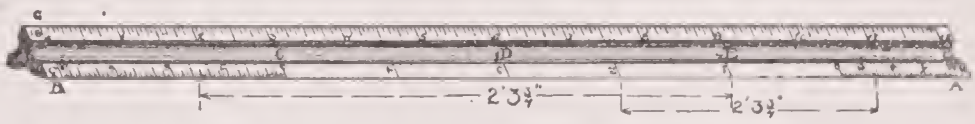


Fig. 17

The instrument shown in Figure 18 is a protractor, and it is used for measuring or laying off angles, or for dividing a circle into a number of equal parts. The outer edge of the protractor is a semi-circle whose center is at O, and it is divided into 360 equal parts, each of which is, therefore, one-half of one degree. When you wish to use the protractor to measure or lay off an angle, you must place it so that the line OB will coincide with the line that forms one side of the angle to be laid off or measured, and the center O will be at the vertex of the angle.

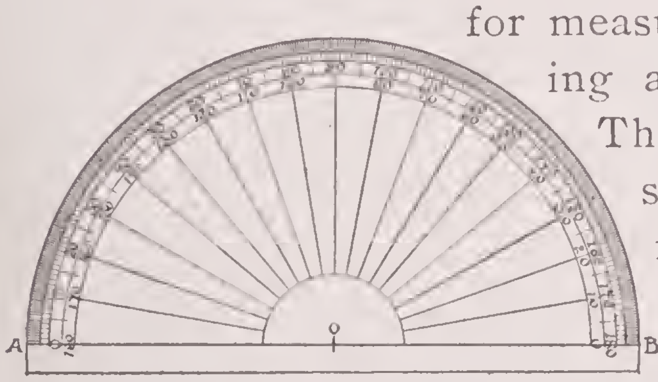



Fig. 18

For example, suppose you desire to lay off an angle of 25 degrees with the line HK, at the point M, Figure 19. Lay the protractor on the paper, with the edge OB coinciding with the line HKO at the point M, then make a mark with a sharp pencil at the 25 degree division on the outer edge of the protractor as indicated at N. A line MXK drawn through M and N will make the required angle of 25 degrees with the line HK.

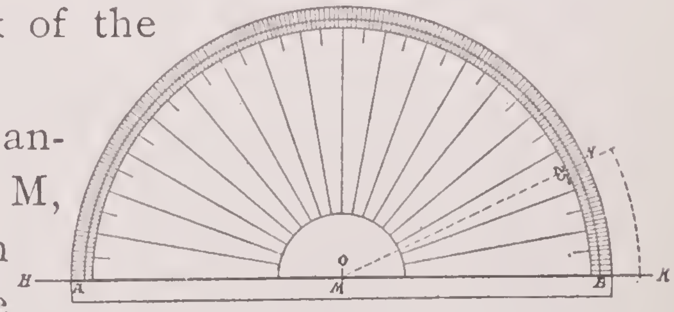


Fig. 19

The best paper to use for mechanical drawing is Whatman's cold pressed white drawing-paper. For the exercises described in the following pages, the demy size, which measures 15 by 20 inches, is the most convenient. This paper bears wetting without injury, its surface is not easily marred by the use of the eraser, and both pencil and ink lines of a sufficient degree of fineness can be made on it without difficulty.

Thumb-tacks are used to fasten the paper securely to the drawing-board, and you should provide yourself with about a dozen of them. They are simply broad-headed tacks, designed to be pressed into the drawing-board with the thumb, and consequently their points are thinner than, and not so long as, those of ordinary tacks.

As there are always a number of lines made during the execution of a finished drawing that must be erased, you should include in your outfit a pencil-eraser of soft rubber, which will not smudge the paper when used, and a rubber ink-eraser. The ink-eraser should contain enough cutting material to erase ink lines easily, but it should be fine, and should not roughen the surface of the drawing-paper enough to make it difficult to draw fine, smooth lines upon it. A piece of the porous material known as sponge or molded rubber is useful in "cleaning up" drawings, for it removes the stains that are often caused by the hands and freshens the surface of the paper without roughening it. Sponge rubber is not necessary, however, for a piece of bread two days old can be used in its stead with excellent results.

The ink used in mechanical drawings is a very important factor, for inferior ink will detract greatly from the good appearance of a drawing. The ink used is always India ink, but it is sold in two forms, the solid, or stick form, and the liquid. Draftsmen who do a great deal of drawing generally use the solid ink, which they prepare freshly every morning by grinding a small quantity of it in a little glass or porcelain dish with some water. The ink prepared in this way varies in quality, and it requires much time to prepare it each day; so, for the work required by the exercises of this course, the liquid ink is recommended as more satisfactory, though it is more expensive. The best brand of liquid drawing-ink is Higgins's Waterproof. This is sold in bottles of convenient size, each of which has attached to the stopper a piece of quill trimmed to a blunt point, and designed for use in supplying the drawing-pen with ink.

## PRELIMINARY DIRECTIONS AND EXERCISES

After we have examined our instruments and our materials, and learned their construction and uses, let us take a sheet of drawing-paper and fasten its upper left-hand corner to the corresponding corner of the drawing-board with a thumb-tack. Lay the T-square across the board near the upper edge of the paper, with its head pressed against the left-hand edge of the board, and draw the paper smooth upon the board, with its edge parallel to the edge of the T-square. Taking care not to tear the corner of the paper from beneath the first tack, press a second one into the right-hand upper corner of the sheet. Now draw the sheet carefully and firmly downward, and fasten the lower corners so that the whole sheet lies smooth and will not wrinkle under the T-square or triangles.

Now take the drawing-pencil, sharpened at one end to a flat, chisel-shaped point and at the other to a sharp, round point, and practise drawing light lines, using the T-square and triangles for guides. Hold the pencil with its top tipped a little to the right, and also from the body, so that its very tip will follow the guide; otherwise it may rock to and fro and draw a crooked line, even though the guide be perfectly straight. The tip of the lead should never be wet with the tongue, nor pressed so hard against the paper as to make a crease in it, for either of these habits will make trouble, since it is difficult to erase the lines. The round point of the pencil should be used only to mark points, and lay off measurements from the scale.

Pencil lines should always be drawn from left to right against the T-square or other guide, and should always be of the proper length; that is, they should never run over the point at which they are to meet other lines, unless that point can be found only by the crossing of the lines. If pencil lines are drawn haphazard, and longer than necessary, they will be very apt to mislead when the learner attempts to ink them in.

The pencil-points should always be kept sharp, so that all lines will be fine and all measurements correct. *Accuracy* is the draftsman's very best motto, and *neatness* is just as necessary, else the work will look inaccurate, however careful the measurements may be. It is well, also, to wipe the T-square and triangles with a soft cloth to remove dust, before placing them upon the drawing.

After the pencil drawing is finished, the lines must be "inked in." For this purpose, take the ruling-pen and, holding it to the light, turn the screw so that the blades are open just enough to make a

moderately fine line. Fill the pen by placing the ink between the blades with an ordinary writing-pen, or the quill fastened to the cork of the bottles of liquid ink. Be careful that no ink gets upon the outside of the pen, wiping it if necessary; for if ink touches the edge of the T-square or triangle, it will smear at once, making a blurred, ragged line, and making it impossible to lift the guide from the paper without dragging the ink into a still wider blot, which can never be erased without spoiling the surface of the paper so that a smooth line can no longer be drawn upon it.

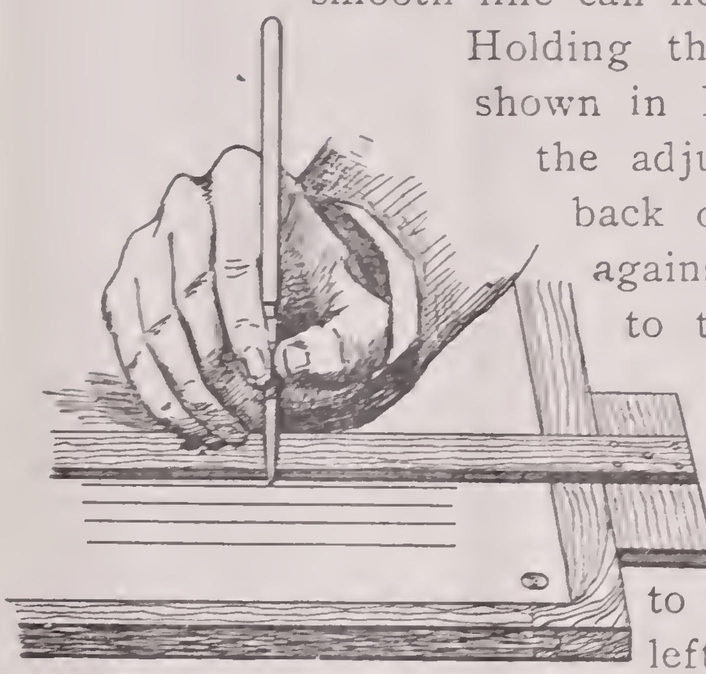


Fig. 20

Holding the pen between the thumb and forefinger, as shown in Figure 20, with the tip of the finger resting on the adjusting screw and the second finger placed just back of the lower blade to support it, place the pen against the T-square or triangle and perpendicular to the paper, so that the tips of both blades will rest squarely upon it; otherwise the line will be uneven and ragged on that side not touched by the tip of the pen-blade. It may sometimes be convenient to tip the top of the pen slightly to the right, since the line is always drawn from left to right, but if the pen be sharpened correctly this will seldom be necessary. The pen should always rest lightly against the T-square or triangle, because if pressed hard against the guide, its blades will be forced together and the lines will be of uneven width.

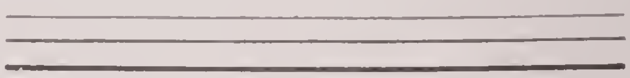


Fig. 21

Before trying to ink a drawing, it will be best to practise by drawing lines of different widths; first fine, then medium, and, lastly, as coarse as the pen will readily draw, as shown in Figure 21. Some trouble may be found in making the ink flow freely from the pen, especially in drawing fine lines, because the ink rapidly dries near the tips of the blades. If a smooth, unbroken line cannot be started by touching the point of the pen to the tip of the wetted finger, the pen should be wiped out and refilled. The width of the line may be tested by drawing short strokes on the border of the paper, which will be trimmed off from the finished plate.

In drawing very coarse lines, more care must be taken that the ink does not run from between the blades against the guide, particularly if the guide be a curved one. The pen must be full enough to make a line of the desired length, since a broad line rapidly empties it, and it is difficult to "piece out" a line smoothly after refilling the pen.

After having drawn solid lines of different widths, the learner should practise upon dotted lines, broken lines, and broken and dotted lines, as shown in Figure 22; taking pains to make the dots and spaces, or broken lines and spaces, of uniform length, whatever may be the width of the line.

Fig. 22

Now, setting the pen for a moderately fine line, draw a number of such lines parallel and at equal distances apart, using the eye only as a guide in spacing them, as in Figure 23.

Fig. 23

The practice may be further varied by using the T-square and 45-degree triangle to draw parallel lines, as in the three following figures :—

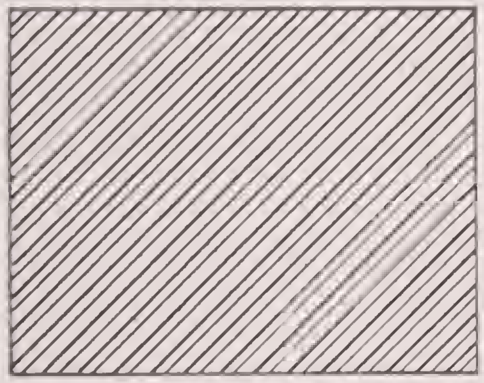


Fig. 24

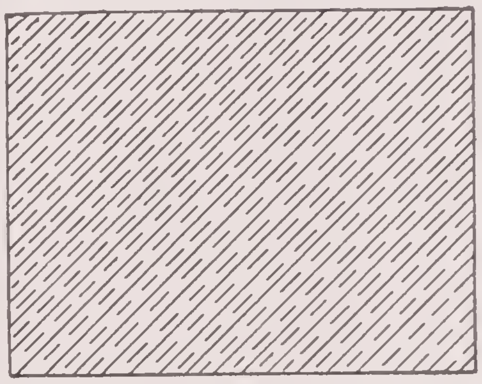


Fig. 25

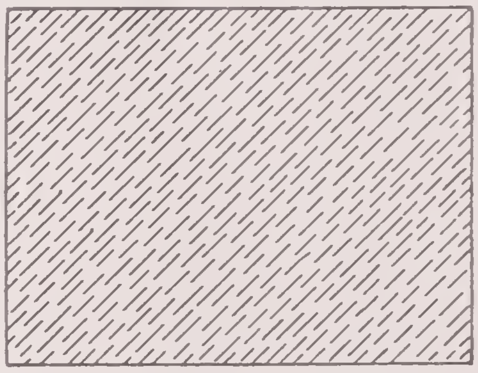


Fig. 26

This manner of lining is often used to represent cut surfaces of metals and other materials, as will be explained further on.

We may next practise with the bow-pen, and compasses, drawing circles of various diameters in both fine and coarse lines, and making them first concentric; that is, all having the same center but different diameters, and drawing the finer lines of smaller diameter, as in Figure 27, making the smallest perhaps one-half inch in diameter, the next three-quarters inch and so on, to as large a circle as the instruments will readily draw.

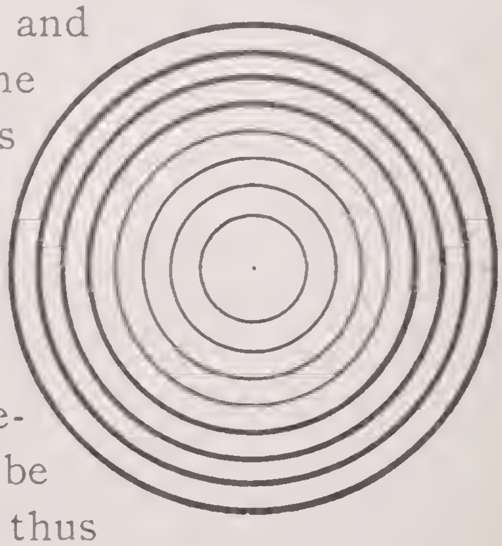


Fig. 27

We should always remember that in placing the needle-point so many times on the same point, great care must be taken not to make a large hole in the drawing-paper, and thus displace the outer circles so that they will no longer be concentric. As the legs of the compasses are gradually opened for each succeeding circle, see that both pen and needle-point are bent inward so that they may be perpendicular to the paper and thus bring both the pen-points squarely upon the paper to avoid ragged lines. Try, also, to adjust the pen-points so that the lines shall increase uniformly in thickness.

Lastly, adjusting the bow-pen to draw a moderately heavy line, draw two semicircles whose centers are on the same horizontal line and about two inches apart. Be careful to draw exactly half a circle, and then with a triangle and ruling-pen join the semicircles with straight lines of the same width. This will give practice in joining straight and curved lines, and this plan should always be followed when inking in drawings; that is, draw all circles and other curved lines first, and finish the inking by drawing the straight lines and joining them to the curved ones, as it can be more neatly done than by attempting to join the curved lines to the straight lines.

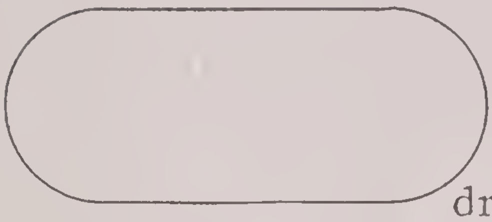


Fig. 28

When the above exercises have been practised enough to make the work accurate and neat, the learner will be ready to ink simple drawings. For this work, use a moderately fine line, but not so fine that the pen will work poorly, or the lines be hard to distinguish from dimension lines, center lines, etc. They should be full lines, except where they indicate hidden parts of the object, which parts should be shown by dotted lines.

Always begin by inking the smaller circles, then the larger circles and other curved lines, and lastly the straight lines. When all curves and circles have been inked, begin at the top of the drawing and, using the T-square, ink all the horizontal straight lines; then, beginning at the left of the drawing, ink all vertical straight lines. If lines of more than one width be used, such as shade lines, which will be explained further on, do not change the adjustment of the pen-blades, but ink all lines of the same width at one setting of the pen; then alter the adjustment and ink those of the other width, otherwise the lines will vary in width on different parts of the drawing and spoil its appearance.

The construction lines, that is, those which determine the size and shape of the object; the center lines, or those which show the centers of holes and of regular or "symmetrical" objects; and the dimension lines, or those which show the size of the object, should be inked last of all, and the ends of dimension lines should bear neat arrow-heads, touching the lines between which the dimensions are taken, as in Fig. 29. These arrow-heads are best made with a fine writing-pen.

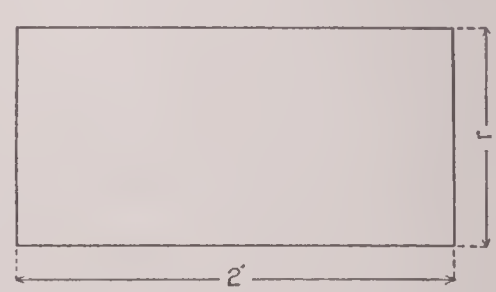



Fig. 29

For inking in, some draftsmen prefer to use triangles of celluloid, or other translucent material, so that the penciled lines can be seen through them and the danger of drawing ink lines beyond the desired points avoided. Such triangles, however, are apt to warp and thus make the work inaccurate.

## LETTERING

After the drawing of an object has been finished, the title of the plate, the names of the different figures, etc., should be neatly lettered upon the sheet. Ordinary script writing, however good the penmanship, is never uniform enough to give a finished appearance to a drawing.

In choosing a style of letter for drawings, one should be selected which is neat, easily made, and easily read. Usually, a simple, open letter which can be rapidly made, either "free-hand" or with the drawing instruments, is best. Except on maps, elaborate titles, cornerpieces, and borders should not be attempted.

By remembering three rules, the young draughtsman will soonest learn to become rapid and neat in lettering his drawings. These rules are: —

1. Give all letters a uniform slant.
2. Space correctly.
3. Do not attempt too many styles of letter.

For titles of plates, headings, etc., a Gothic or block letter is most suitable; while, for descriptions of figures and all other lettering in the body of a plate, a simple Italic letter can usually be most rapidly made and, if carefully made, is very neat. With sufficient practice, "round writing" is a very rapid means of lettering, but it requires special pens, should always be written between guide lines, and, until skilled by long practice, the learner would better use some simpler style.

Below are given several styles of alphabets which have been found most useful in lettering mechanical drawings: —

1. Block letter.

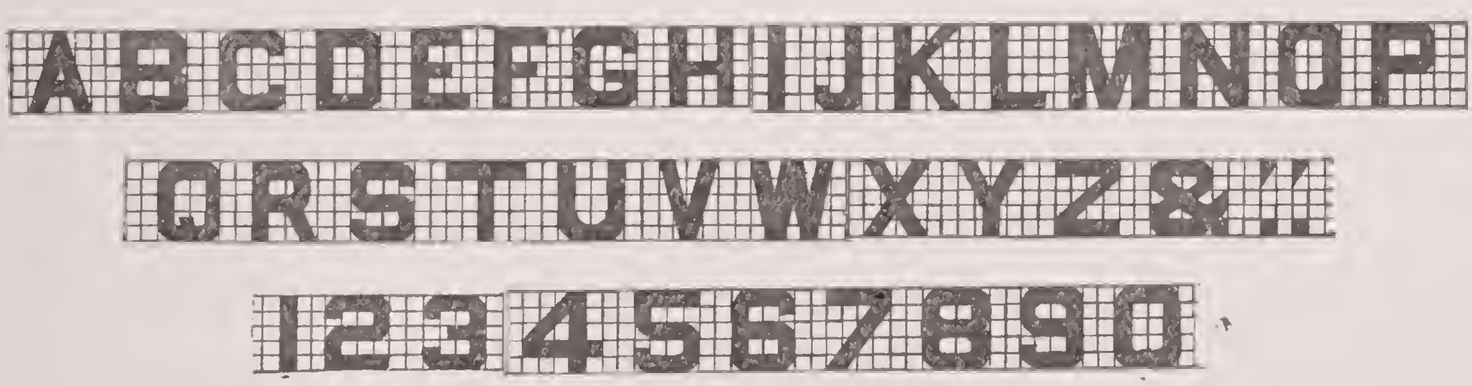



Fig. 30

2. Italic.

*AABCDEFGHIJKLMMNNOPQRSTUUVVWXYZ&*

*abcdefghijklmnopqrstuvwxyz,.* *$1234567890*

Fig. 31

3. Square.

abcdefghijklmnopqrstuvwxyzœæ,.

ABCDEFGHIJKLMNOPQRSTUVWXYZ&ÆŒ $1234567890

Fig. 32

4. Round writing.

abcdefghijklmnopqrstuvwxyz,.

ABCDEFGHIJKLMNOPQRST
UVWXYZ& $1234567890

Fig. 33

In drawing the block letters, it is best, in order to give each letter its correct proportions, to divide the height of the letter into five equal parts and make the widths as follows: All the letters and figures except I, M, and W, and the figure 1, should be four such parts in width, M being five parts, W six parts, and I and 1 but one part. The thickness of all the lines should be one part. A good size for ordinary lettering is five-sixteenths of an inch in height, the greater number of the letters then being one-fourth of an inch wide.

The distance between any two letters in a word should be one space, except when A follows P or F; when V, W, or Y follows L; when J follows F, P, T, V, W, or Y; when T and A, or A, V, W, or Y are side by side. In these cases, the bottom of the A, J or L and top of the other letter should be in the same vertical line.

These letters being made up of straight lines, can all be drawn with the T-square and triangle. Draw six equally-spaced horizontal pencil lines to outline the height of the letters and then, using the triangle, draw the letters with their correct width and spacing in lead-pencil. After all are penciled, ink all the straight lines with the ruling-pen, rounding the corners and filling in the width of the lines with a lettering-pen, for which work a Gillott's No. 303 or Spencerian No. 1 will be suitable.

For all descriptions, Italic, or, if the learner prefers, the square letter, will be most easily and rapidly made. The height of capitals should be three spaces and that of the small letters two spaces. A good size for ordinary lettering is three thirty-seconds and one sixteenth, respectively. Be sure to draw the horizontal guide lines in all cases: and, to make sure that the slant is uniform, draw guide lines with the 60-degree triangle short distances apart across the horizontal lines. (See Fig. 34.)

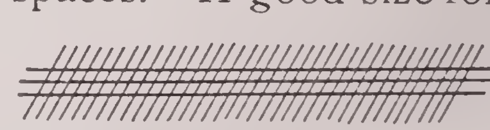


Fig. 34

The main point to be borne in mind is to make the letters *exactly uniform* in height and slant, and this will require considerable time and practice. Do not be discouraged. Even experienced draftsmen require time to do neat lettering,— much more time than for ordinary writing. Pencil all letters first, to train the eye in spacing, and do not hurry, or crowd the letters together. The tendency of all beginners is to fail to space the letters far enough apart. Give plenty of room to each, and make all curved letters smooth and bold.

In the Italic alphabet, attention should be given to the capitals A, M, V, W, X, and Y. These must be so printed that the *general slant* of the letter will be the same as that of the other letters. This may be done by drawing a center line on the common slant and then spacing the bottom of the A, the top of the V, etc., equal distances on each side of the guide line, as is shown on an enlarged scale, Figure 35.

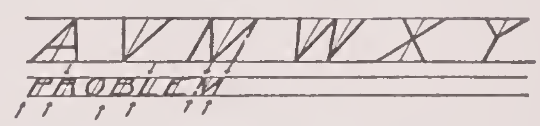


Fig. 35

The small letters h, m, n, and r should have sharp points at the bottom as shown in the alphabet, and n, w, and y should have sharp-pointed tops as there shown.

The square letter, like the block or Gothic letter, can be made almost entirely with the T-square and triangle, after proper guide lines have been drawn, giving the letters a general slant of 60 degrees.

In all cases, where there is more than one line of letters, the space between the lines should not be *less* than the height of the letters themselves; it is usual to make the space just equal to the height of the line of lettering.

## GEOMETRICAL CONSTRUCTIONS

As NEARLY all mechanical drawing is based upon geometry, it is necessary that the draftsman be able to draw the simpler geometrical constructions that are almost constantly in use in representing objects. Their construction will at the same time give valuable practice with the instruments.

Since these problems need not be drawn on a large scale, several can be placed on a single sheet of drawing-paper. If a demy size sheet (15 inches x 20 inches) be used, the learner should, after fastening it on the board as directed, draw a pencil outline 14 inches x 19 inches, leaving a margin of about half an inch to be trimmed from the finished plate. One-half inch from the edges of the plate thus outlined, draw a border line, leaving the space within 13 inches x 18 inches. This space can now be divided into six rectangles, each 6½ inches high and 6 inches wide, by drawing a light horizontal pencil line across the center of the

plate, and two vertical lines 6 inches apart and each 5 inches from the end border lines. Use these dividing lines only as guides in locating the figures and erase them when the plate is completed.

Place the number of the plate on the half-inch upper margin, and midway of the length of the plate. Place the description of each figure or problem above the figure, spacing the line one-half inch from the top of the rectangle containing the figure. Use either Italics or square letters, making them $\frac{3}{32}$ inch high, and if more than one line is necessary to describe the figure, make the distance between the lines also $\frac{3}{32}$ inch. Begin each line one-half inch from the left-hand side of the rectangle inclosing the figure.

All construction should be dotted, making dots and spaces each about $\frac{1}{16}$ inch long. All required lines, that is, all lines necessary to complete the figure called for by the problem, should be moderately heavy, solid lines, and all given lines, or lines necessary as a basis for the problem, should be light, solid lines.

## PROBLEMS

1. To CONSTRUCT an angle equal to a given angle (Fig. 1):

Draw any two lines, as CA and BA, each $2\frac{1}{2}$ inches long and meeting at A at any angle. Above the angle CAB draw the line A′B′ $2\frac{1}{2}$ inches long. With the compasses opened to a radius A*d*, slightly less than AB, strike the arc *de*, using A as a center. From A′ on the line A′B′, with a radius A′*d*′ equal to A*d*, strike the arc *d*′*e*′ somewhat longer than *de*. Now placing the needle-point of the compasses at *d* measure that part of the arc *de* lying between the lines AB and AC by bringing the pencil-point exactly to the point where arc *de* crosses line AC. Keeping the compass-legs in the same position, now place the needle-point at *d*′ and strike a short arc crossing *d*′*e*′. From the point A′ now draw the line A′C′ $2\frac{1}{2}$ inches long and passing through the intersection (that is, the point of crossing) of the arc *d*′*e*′ and the shorter arc. Then the angle C′A′B′ will equal the angle CAB.

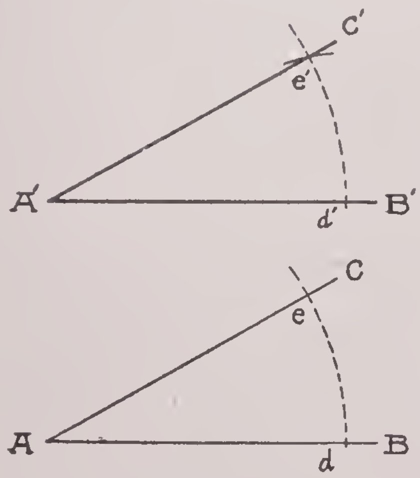


Fig. 1

2. To construct an angle of 60 degrees (Fig. 2):

Draw a horizontal line, as DE, 3 inches long. From a point A, about $\frac{1}{2}$ inch from D, with a radius AB, slightly less than AE, strike an arc BF. With *the same radius*, and B as a center, strike a short arc crossing BF at *e*. From the point A

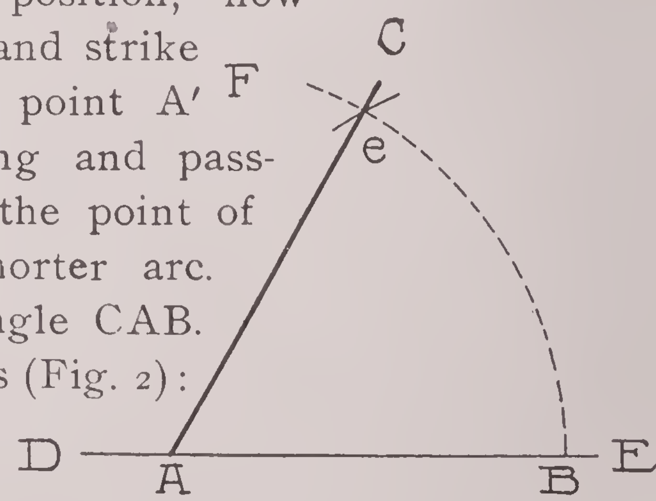


Fig. 2

draw AC $2\frac{1}{2}$ inches long through the intersection of the two arcs Then the angle CAB will be an angle of 60 degrees.

3. To bisect a given angle (Fig. 3):

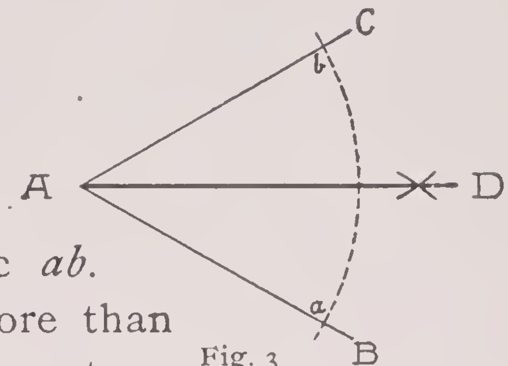


Fig. 3

Let CAB be any angle whose sides are the lines AC and AB, each $2\frac{1}{2}$ inches long. With A as a center and A*a*, slightly less than AB, as a radius, strike the arc *ab*. Now, closing the compasses till the radius is a little more than one-half the arc *ab*, strike short arcs from *a* and *b* as centers, intersecting as at O. From A draw the line AD through the point O; and the angles CAD and DAB will each equal one-half of CAB. In other words, AD bisects the angle CAB.

In constructing this figure, draw the lines AB and AC at such angles that the bisector AD, when drawn, will be nearly horizontal.

4. To bisect a straight line (Fig. 4):

Draw the horizontal line AB, 3 inches long. With the compasses open to a radius slightly greater than one-half of AB, and using A as a center, strike short arcs as at D and E, above and below the line AB. With the same radius, and B as a center, strike arcs intersecting the arcs struck from A. Connect the intersections at D and E with a dotted line, and the point C, where it crosses AB, will be the middle point of AB. The dotted line DE not only bisects AB, but is at right angles, or perpendicular to it.

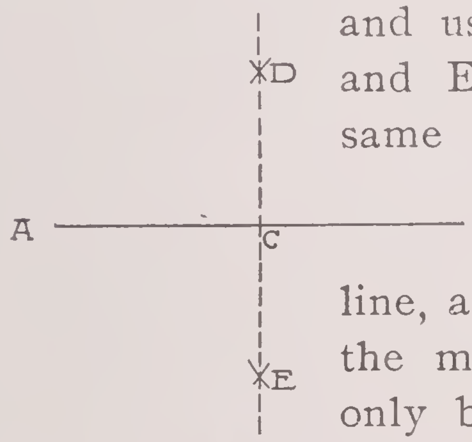


Fig. 4.

5. To draw a perpendicular to a straight line from a point within that line (Fig. 5):

There are two methods of solving this problem, one more convenient when the given point is near the center of the line, and the other when it is near one end of the line.

First case: When the given point is near the center of the line. Draw the line AB 3 inches long and choose the point C near its center. With a radius less than either CA or CB, and the point C as a center, strike short arcs intersecting the line AB at D and E. With a radius greater than one-half of DE, and with first D and then E as centers, strike short arcs intersecting as at F. From C, draw the line CG through the intersection of the arcs at F, which line will then be perpendicular to AB, at the point C.

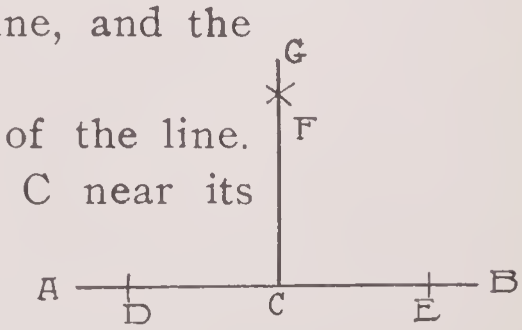


Fig. 5—First Case

Second case: When the given point is near the end of the line: As before, draw AB 3 inches long and take the point C about $\frac{1}{4}$ inch from one end. With any point, as P, and a radius equal to PC, strike the arc ECD, intersecting AB in E and C and continue it for some

distance above AB. From E, draw the line EPD through the point P till it intersects the arc ECD as at D. Join C with the point of intersection of the line EP, and the arc and the line CD will be perpendicular to the line AB at the point C.

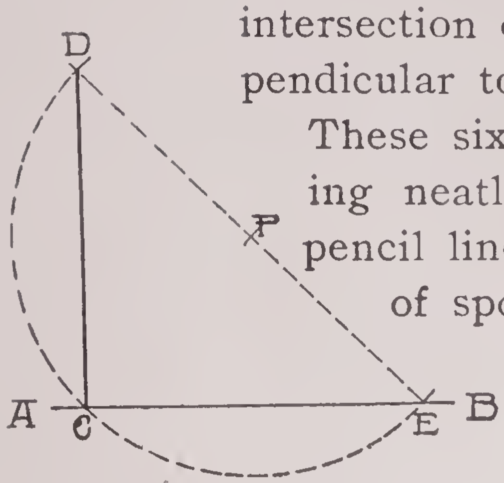


Fig. 5 — Second Case

These six figures will complete a plate, which, after inking, lettering neatly, and inclosing with a border line should have all pencil lines carefully erased and the whole cleaned with a piece of sponge rubber or, what is almost as useful, a slice of stale bread. The sheet should then be trimmed to 14 inches by 19 inches and laid away without rolling.

In giving lengths and directions of lines in the above problems, it must be remembered that they are given only to secure figures of convenient size and location, and to make them easier of construction; since the length and direction do not affect in any way the accuracy of the work or the principle set forth in the problems.

6. To draw a perpendicular to a line from a point outside (Fig. 6):

First case: When the point is nearly over the center of the line. Draw AB 3 inches long and let C be the chosen point outside the line. With C as a center, and a radius greater than the shortest distance to AB, but not so great as to reach beyond either A or B, strike an arc intersecting AB in two points, as D and E. With a radius greater than one-half of DE and using first D and then E as centers, strike short arcs on the side of AB opposite to C and intersecting as at F. Draw a line from C through the intersection of the arcs at F, which line will then be perpendicular to AB, from the point C.

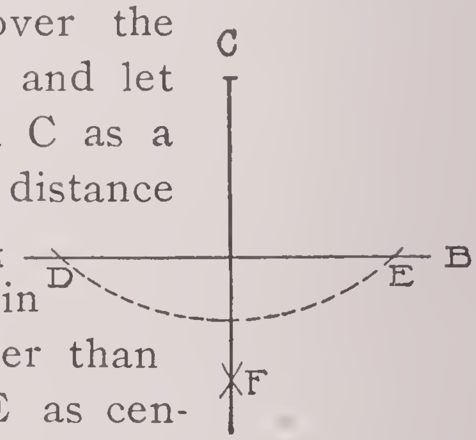


Fig. 6 — First Case

Second case: When the point is nearly over one end of the line. Draw AB 3 inches long and let C be the chosen point outside AB. With any point on the line AB, as P, and a radius equal to PC, strike an arc passing through the point C and extending at least an equal distance on the opposite side of AB. Now, using as a center the point D where the arc intersects AB, and a radius equal to DC, strike short arcs intersecting the first arc at C and E. Join the intersections at C and E with the line CE, which will then be perpendicular to AB from the point C.

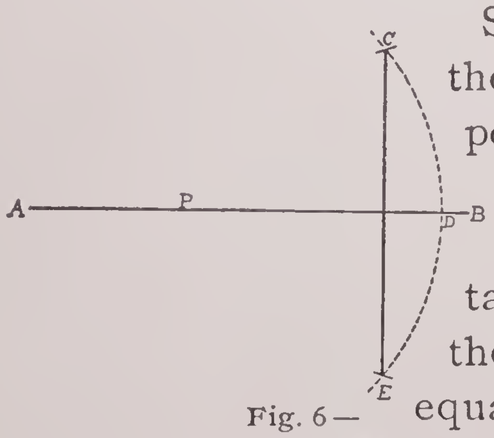


Fig. 6 — Second Case

7. To draw a parallel to a given line from a point outside (Fig. 7):

Draw AB 3 inches long, and with O, the given point outside AB as a center and a radius slightly less than the distance OB, strike an arc intersecting AB as at F. With F as a center and the same

radius, strike an arc passing through O and intersecting AB as at G. Set the compasses to the radius OG, and from G and F as centers strike short arcs intersecting the first arcs at O and E. Through the intersections O and E, draw the line CD 3 inches long, which will then be parallel to AB and pass through the given point O.

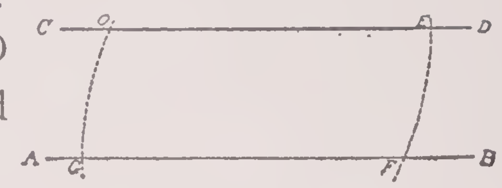


Fig. 7

8. To divide a given line into any number of equal parts (Fig. 8):

Draw AB 3 inches long, and let the problem be to divide it into nine equal parts. Since this cannot be done by divisions found on the scale, draw the line AC from A, and making any convenient angle with AB. Make AC of sufficient length so that nine equal spaces of convenient length, as A–1, 1–2, etc., can be laid off upon it. Join the last point at 9, with the end B of AB by a dotted line, and through the points 8, 7, 6, etc., draw dotted lines parallel to 9–B, using the two triangles in the manner already described. Then will AB be divided into nine equal parts A–1′, 1–2′, etc.

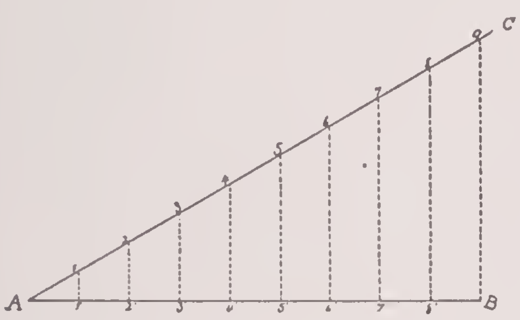


Fig. 8

9. Having given the three sides of a triangle, to construct the triangle (Fig. 9):

Draw the lines DE 3 inches long, FG $2\frac{5}{8}$ inches long, and HI $2\frac{1}{2}$ inches long, as the given sides of the triangle.

Now draw AB equal in length to DE and horizontal. With B as a center, and a radius equal to the line FG, strike an arc as at C. With A as a center and a radius equal to HI, strike another arc intersecting the first. From A and B draw lines to the intersection of the arcs; then will ABC be the required triangle.

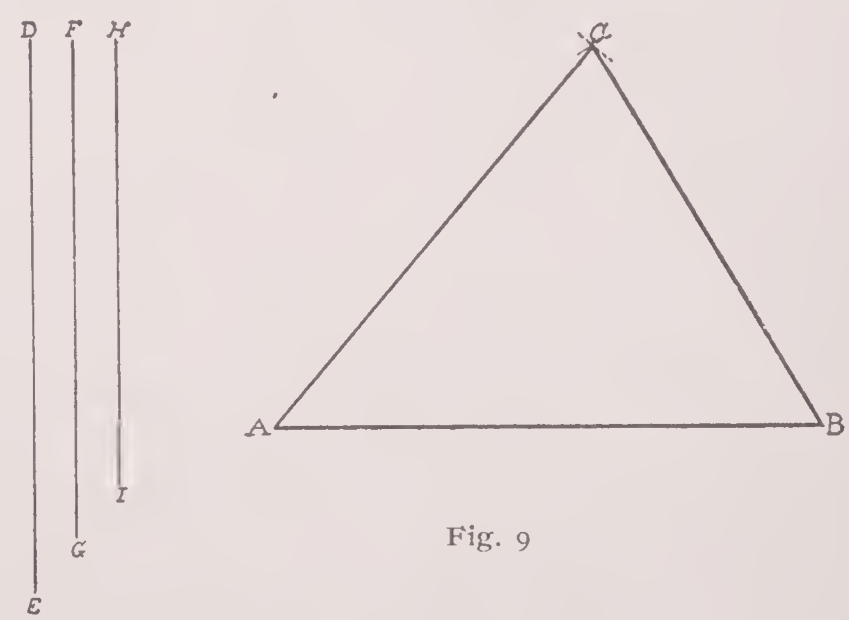


Fig. 9

Of course it makes no difference whether the distance FG is laid off from B or A. It is easy to see that the triangle will be of the same size, but reversed in position; or in geometrical language, "symmetrical," with the triangle as constructed above.

10. Having given two sides and the included angle of a triangle, to construct the triangle (Fig. 10):

Draw the lines DE $3\frac{1}{8}$ inches long, and FG $2\frac{1}{4}$ inches long, and let O be the given angle. Draw the horizontal line AB, equal in length to DE, and at B lay off an angle equal to the angle O, in

the manner shown in problem 1. From B draw BC, equal in length to FG, and making an angle with AB equal to O. Join A and C and ABC will be the required triangle.

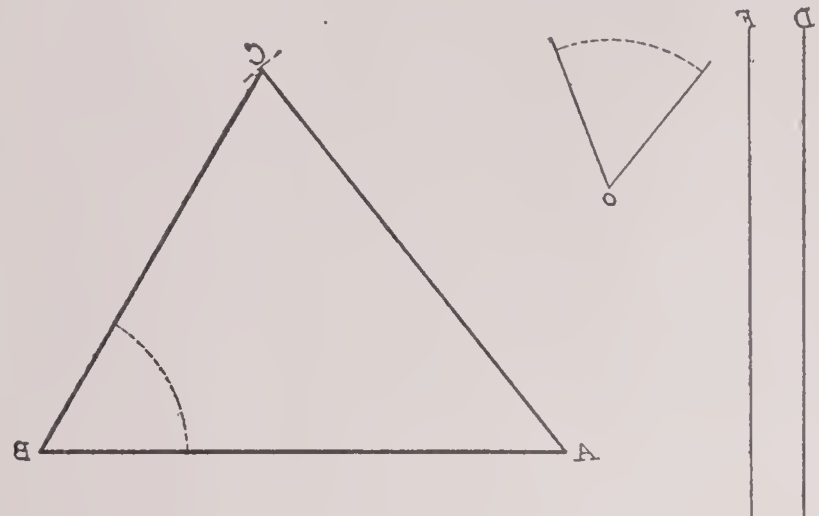


Fig. 10

Problems 6 to 10 furnish figures for a second plate which should be lettered and finished in a manner similar to Plate I.

11. To find the center of a given arc, having given its radius (Fig. 11):

AB is the given arc whose radius CD is 2 inches. From any two points in the arc, as E,F, which, for the sake of greater accuracy should be a considerable distance apart, and with a radius equal to CD, strike arcs intersecting as at O. O is then the center from which AB was struck.

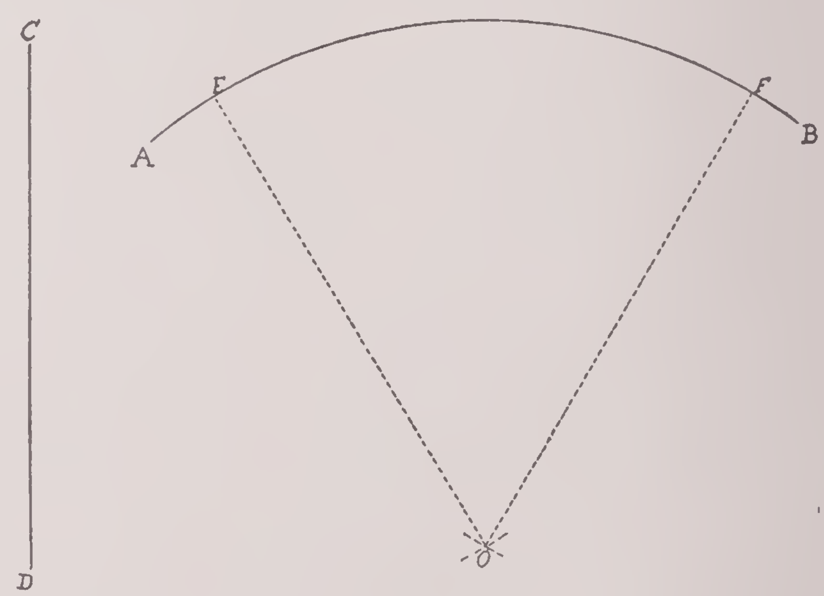


Fig. 11

In constructing this problem, the arc AB cannot be struck with the compasses without at once locating the center O, but the construction at once proves that O may be found in this manner, even though the arc were traced with a circular guide and its center not known.

The dotted lines EO and FO may be omitted if the learner prefers.

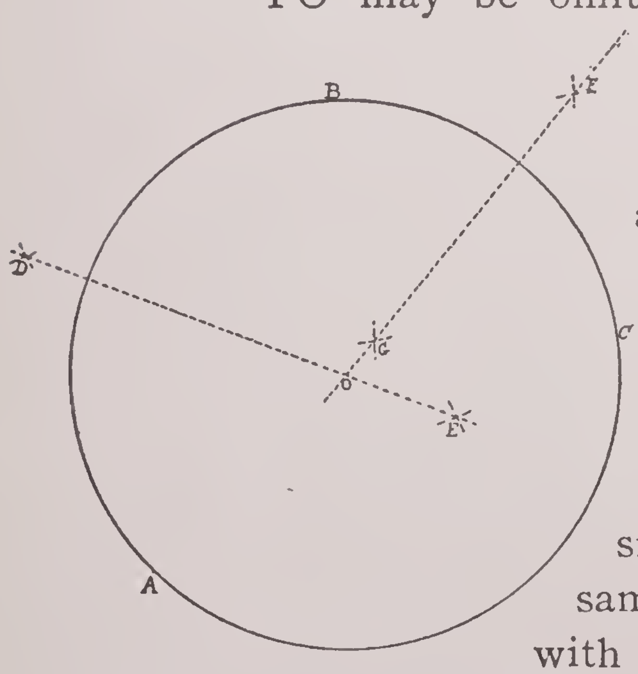


Fig. 12

12. To pass a circle through three points not in the same straight line (Fig. 12):

Choose the three points A, B, and C in such a manner that the circle when completed will not be too large; for it is easy to see that the more nearly the points approach the same straight line, the larger must be the circle which shall pass through all.

With A and B as centers, and any raidus greater than one-half AB, strike intersecting arcs on both sides of the imaginary line joining them. In the same manner, strike intersecting arcs from B and C, with a radius greater than one-half BC. Draw dotted lines through the intersections at D and E; also through those at F and G, and if necessary, prolong one or both of these lines until they intersect, as at O. From O as a center, with a

radius OA (or OB or OC), draw a circle which will pass through the two other points.

13. To draw a tangent to a circle at a given point in the circumference (Fig. 13):

A tangent to a circle or other curve is a line which touches the curve at a single point without crossing it.

Let O be the center of a circle 3 inches in diameter, and P the point at which it is required to draw the tangent. Through O and P, draw a dotted line and prolong this line outside the circle a distance, PQ, equal to the radius of the circle. Now bisect the line OQ in the manner shown in problem 4. This bisector will pass through P, and be tangent to the circle at that point.

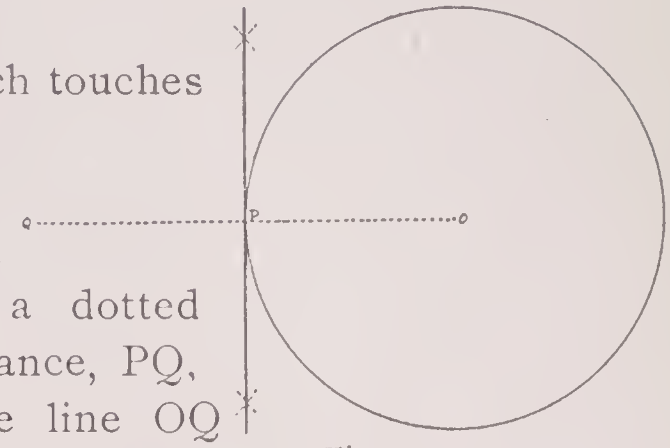


Fig. 13

This problem may also be constructed by making OQ of indefinite length, and then drawing a perpendicular to it at the point P, as in problem 5, but the method shown is somewhat shorter.

14. To draw two tangents to a circle from a point without (Fig. 14):

Let O be the center of a circle $2\frac{1}{2}$ inches in diameter, and P the point without from which tangents are to be drawn. Join O and P by a dotted line and bisect this line in the manner before described. From A, the middle point of OP, as a center, with a radius equal to AO, strike the arc BOC, intersecting the circumference of the circle at B and C. Lines drawn from P through B and C will be the required tangents.

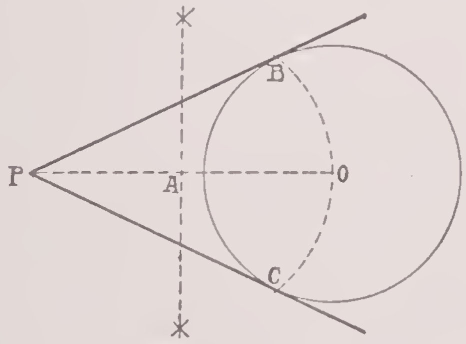


Fig. 14

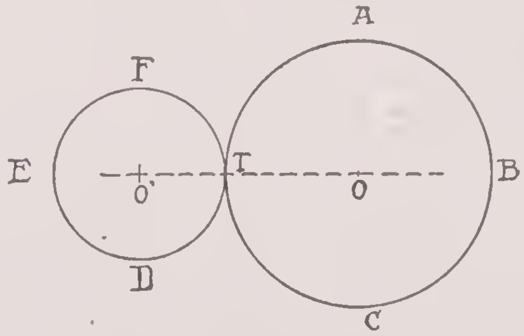


Fig. 15

15. To draw two circles of known radii, tangent to each other externally (Fig. 15):

Let ABC be one of the given circles whose radius is 1 inch, and let T be the point of tangency. From O, the center of ABC, draw the dotted line OT and prolong it outside ABC. Let the radius of the second circle be $\frac{5}{8}$ inch, and from T lay off this radius on the prolongation of OT. Then O′ will be the center of the second circle DEF, which when drawn from O′, with the radius O′T, will be tangent to ABC at T.

16. To draw two circles of known radii, tangent to each other internally (Fig. 16):

Let the radii of the two circles be $1\frac{1}{2}$ inches and $\frac{7}{8}$ inch. Construct this problem like the preceding one, except that the radius of the smaller circle must be laid off from T toward O, so that O′ lies within the circle ABC.

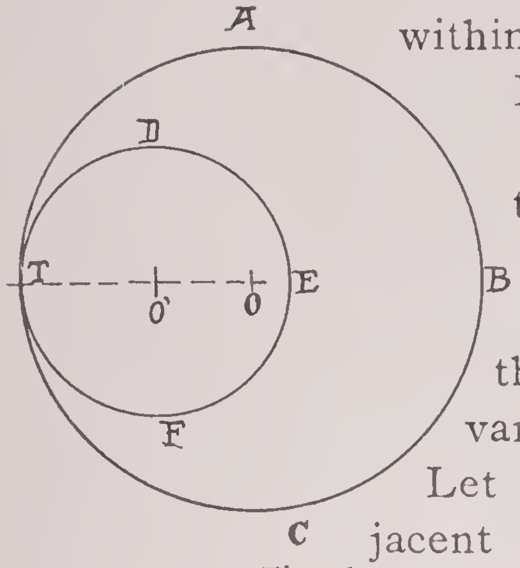


Fig. 16

Problems 11 to 16 furnish figures for a third plate.

17. To draw a parallelogram, when adjacent sides and the included angle are given (Fig. 17):

A parallelogram is a four-sided figure whose opposite sides are parallel and equal. For this reason, it is only the adjacent sides (those which join end to end) which can vary in length.

Let AB, $2\frac{3}{4}$ inches long, and CD, $1\frac{3}{4}$ inches long, be the adjacent sides, and O the angle included between them. Draw EF equal to AB. At E lay off an angle equal to O. From E draw EG equal to CD and making an angle with EF equal to the angle O. From G, with a radius equal to EF (or AB), strike a short arc as at H. From F, with a radius equal to EG (or CD), strike an arc intersecting the arc struck from G. Join G and F with the intersection at H and thus complete the required parallelogram.

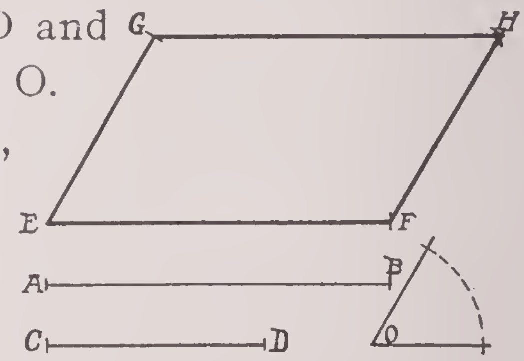


Fig. 17

18. To inscribe a square in a given circle (Fig. 18):

Draw the circle ACBD 3 inches in diameter. With the T-square and 45-degree triangle, draw the diameters AB and CD at right angles to each other and each at 45 degrees to the horizontal. Join the ends of these diameters and the inscribed figure ACBD is the required square.

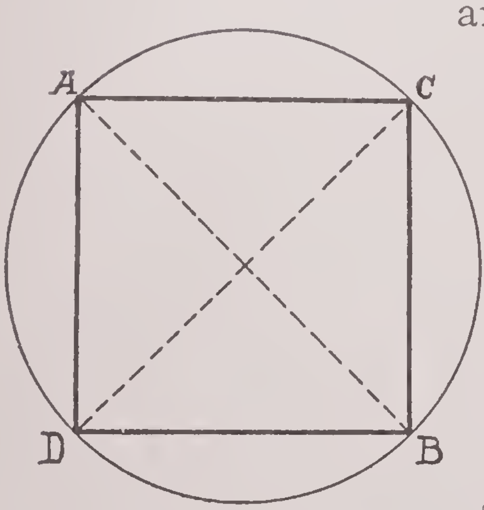


Fig. 18

19. To inscribe a pentagon in a given circle (Fig. 19):

A regular pentagon is a figure with five equal sides and angles. Draw the circle EFGH 3 inches in diameter; also the two diameters AB and CD at right angles to each other. Bisect one radius, as OA, at K. With K as a center and a radius equal to KC, strike the arc CI intersecting AB. With C as a center and a radius equal to CI, strike short arcs intersecting the circumference at E and H. With the same radius, and E and H as centers, strike other arcs across the circumference at F and G. Measure FG to see that it equals (as it should) the radii just used, as CE, EF, etc. Join the points C, E, F, G, and H and the figure will be the required pentagon.

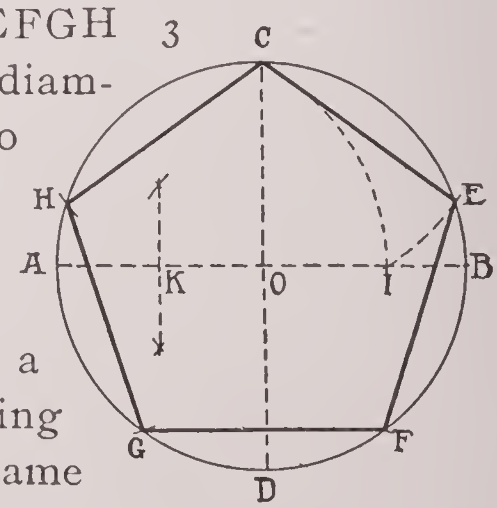


Fig. 19

20. To inscribe a regular hexagon in a given circle (Fig. 20):

A regular hexagon is a six-sided figure with equal sides and angles. Draw the circle ABC, etc. 3 inches in diameter. The radius

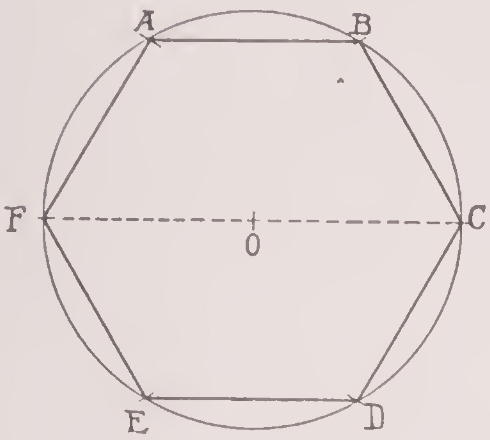


Fig. 20

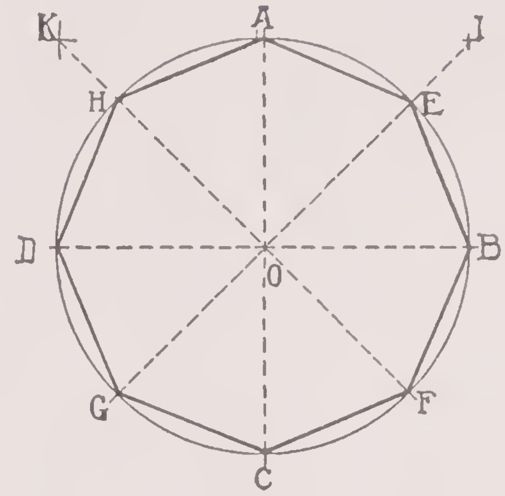


Fig. 21

of any circle is equal to one side of the inscribed hexagon, so that with the radius OC, for example, the divisions CD, DE, etc., can be stepped off around the entire circumference. It is shortest, however, to draw a horizontal diameter, as FC, and with C and F as centers, strike short arcs on each side, as at B and D, E and A. Join the points thus found and the figure ABCDEF is the required hexagon.

There is no convenient method of drawing a regular heptagon (seven-sided figure), and it seldom is used in mechanical constructions.

21. To inscribe a regular octagon in a given circle (Fig. 21):

A regular octagon is an eight-sided figure with equal sides and angles, and it will be at once seen that it may be drawn by beginning as for the inscribed square (problem 18), and bisecting each of the angles.

Draw the circle ABCD 3 inches in diameter, and the diameters AC and BD at right angles. Bisect the angle AOB by short arcs struck at I, as in problem 3. In the same manner bisect AOD, as at K. By drawing dotted lines from I and K through O, the opposite angles, DOC and BOC, are also bisected. Join the points AE, EB, etc., and the inscribed figure will be a regular octagon. The diameters AC, EG, etc., may all be drawn through O by means of the T-square and 45-degree triangle, if preferred.

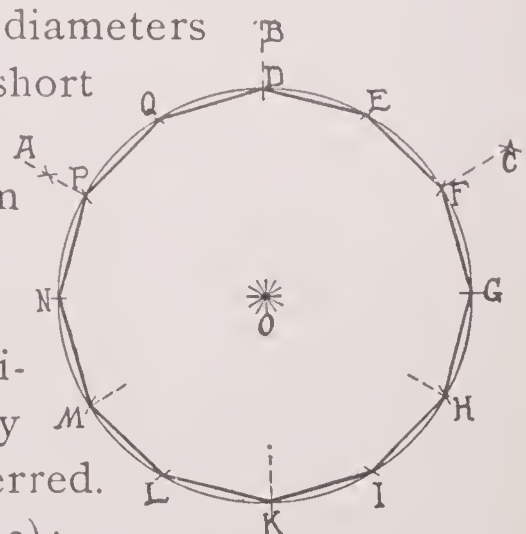


Fig. 22

22. To inscribe a regular dodecagon in a circle (Fig. 22):

A dodecagon is a twelve-sided figure. Draw a circle 3 inches in diameter, and mark six points on the circumference as for a regular hexagon (problem 20). Bisect three adjacent arcs as at A, B, and C, and prolong the bisectors across the center, thus bisecting the opposite arcs.

Join in succession the twelve points thus found and the inscribed figure will be a regular dodecagon.

Problems 17 to 22 furnish figures for a fourth plate.

23. To draw an ellipse, the major axis and distance between the *foci* being given (Fig. 23):

An ellipse is a curved figure, such that if we take a point in the curve and measure the sum of the distance from this point to two points within, called the *foci*, we shall find this sum the same for any and all points in the curve.

To draw a perfect ellipse 3 inches long, draw AB 2 inches long, and place a pin upright in the drawing-board at each end of AB. Double a strong thread, silk is best, and tie a knot in the doubled thread so that the loop will be exactly $2\frac{1}{2}$ inches long. This may require a few trials. Place the looped thread over the pins, and with the pencil-point draw the string straight, as at C. Then pass the pencil around, as is shown by the arrow, keeping the thread always taut. The curve traced by the pencil will be a perfect ellipse. The pencil curve may be inked in by using an irregular curve.

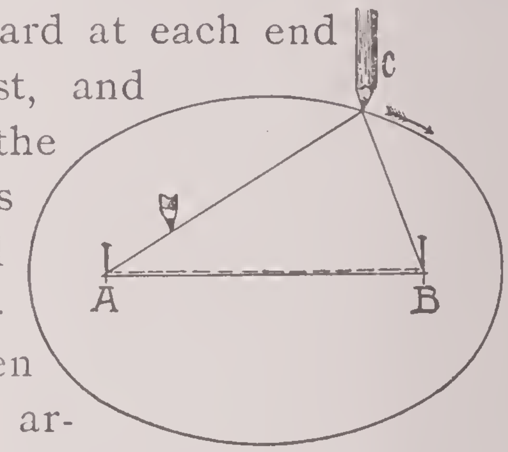


Fig. 23

If we draw a circle on cardboard, then cut it out and hold it squarely before the eyes, it appears circular; but if we tip it in any direction, so that one edge approaches the eye, it is no longer circular in appearance, but elliptical. We see by this that an ellipse may be any shape between a true circle and a straight line. The method shown in problem 23 is not a convenient one, and is given only because it traces a perfect ellipse and shows its properties. There are several methods of drawing an ellipse almost correctly, but the most convenient is that in which the curve is made up of arcs of circles, smoothly joined.

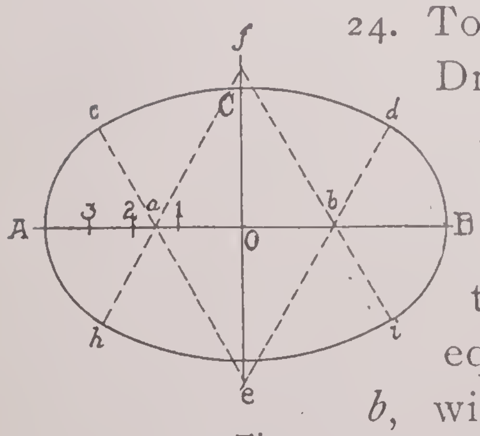


Fig. 24

24. To draw an ellipse by means of circular arcs (Fig. 24): Draw AB, the major axis, 3 inches long, and CD, the minor axis, 2 inches long and at right angles to AB at its center. From B lay off B1, equal to CD, and divide 1A into three equal parts. This can be most easily done by trial, with the dividers. From O lay off O*b* and O*a* each equal to two of the three parts just found. From *a* and *b*, with a*b* as a radius, strike intersecting arcs at *e* and *f*. From *f* and *e* draw dotted lines through *a* and *b*, prolonging them some distance, as to *c*, *d*, *h* and *i*. From *e*, with a radius *e*C, draw the arc *c*C*d*, and from *f*, in like manner, the arc *h*D*i*. From B, with a radius B*d*, strike a short arc across BA, which will inter-

sect very near $b$. From this last intersection as a center, draw the arc $dBi$. In a similar way, find the center for and draw the arc $iAh$. These four arcs complete the required ellipse. This curve is often used in projection drawing, isometric, and perspective, all of which will be explained further on.

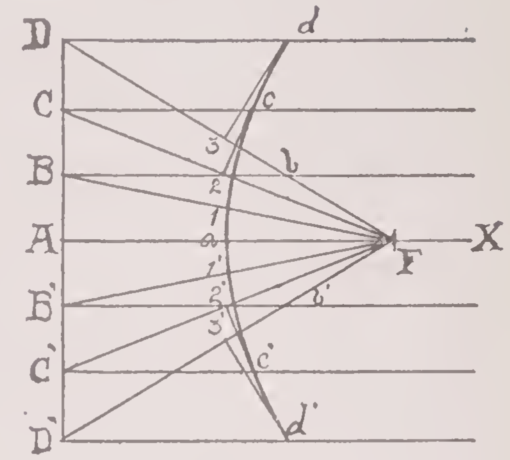



Fig. 25

25. To draw a parabola (Fig. 25):

A parabola is the curve made by a stone thrown into the air in any direction except straight upward. It is also the curve of reflectors which throw a parallel beam of light.

Draw a vertical line DD′ $2\frac{1}{4}$ inches long, and at right angles to its middle point draw AX of any convenient length. At equal distances each side of A, draw parallels to AX, as at B, C, D, B′, C′, D′. On AX choose a point F as the "focus" of the parabola. Bisect FA, as at $a$, for the middle point of the curve. Draw also FB, FC, ED, etc., and bisect each with a perpendicular, as at 1, 2, 3, etc., prolonging each perpendicular till it intersects the horizontal line nearest it. Through these last intersections, as $b$, $c$, $d$, $b'$, $c'$, $d'$, trace a portion of the required parabola, which may be made of any length, by the same method.

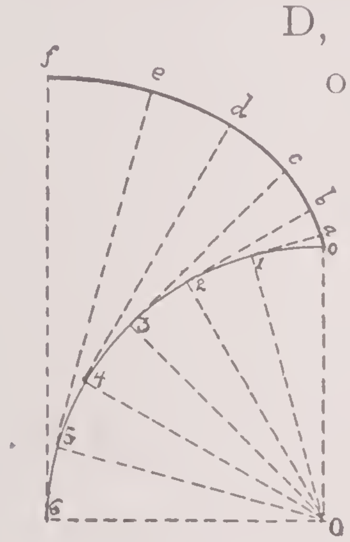



Fig. 26

26. To draw an involute (Fig. 26):

An involute is the curve traced by the end of a thread unwound from a spool, if the thread be held straight while unwinding. It is most used in laying out the curves of the teeth of gears, as will be explained in drawings of machines further on.

As the curve may be made of any length, like the parabola, we will construct but a small portion of it.

Draw a quarter of a circle with a radius of 2 inches. Divide this "quadrant" into any number of equal arcs 0–1, 1–2, etc., six being a convenient number, and draw the radii O$o$, O1, etc. At the end of each radius draw a tangent, as 1$a$, 2$b$, etc. On 1$a$ lay off from 1 a distance equal to the arc 1–0; on 2$b$ lay off from 2, double that distance; on 3$c$, treble that distance, etc. Then through *oabcdef* draw the required involute.

27. To draw a helix of given diameter and pitch (Fig. 27):

This problem will require two spaces on the fifth and last plate of problems. Use the two right-hand rectangles. A helix is the curve of a screw-thread, a coiled spring, or a winding staircase, and its pitch is the vertical distance between any two corresponding points of the curve, as $a'$ and $a''$.

Draw a semicircle, 3 inches in diameter, and divide it into equal parts, say six. With T-square and triangles, draw vertical dotted lines upward from the points of division of the semicircle, those at the sides being $5\frac{1}{2}$ inches long.

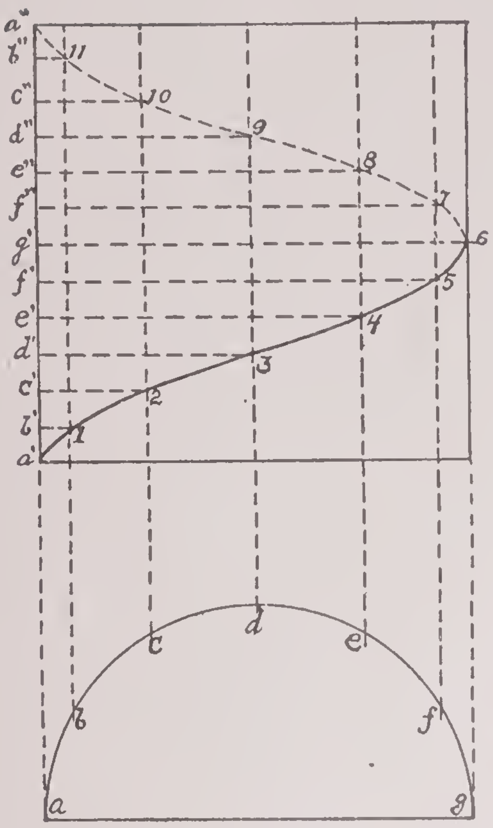


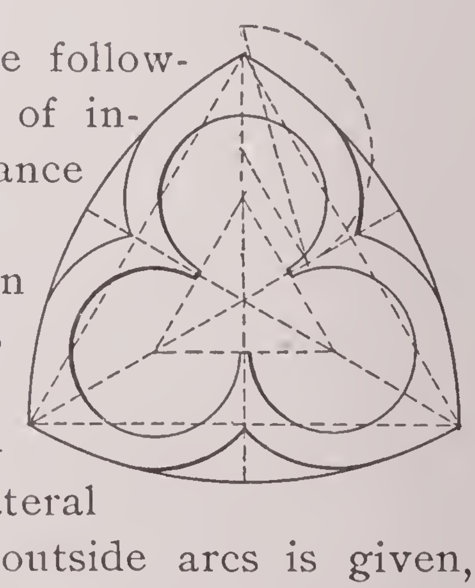
Fig. 27

Taking the pitch of the helix equal to its diameter, 3 inches, lay off on the left-hand vertical line a distance $a'a''$, 3 inches long, and divide it into 12 equal parts (each $\frac{1}{4}$ inch). From $b'c'$, etc. draw horizontal dotted lines till they intersect the vertical lines drawn from $b, c$, etc.

Through the points of intersection, 1, 2, 3, etc., draw the helix, dotting in the upper half where the curve appears to pass to the opposite side of the cylinder around which it winds. It is unnecessary to draw a complete circle beneath the helix, as the points on the lower half are directly beneath those on the upper half, when divided into the same number of parts.

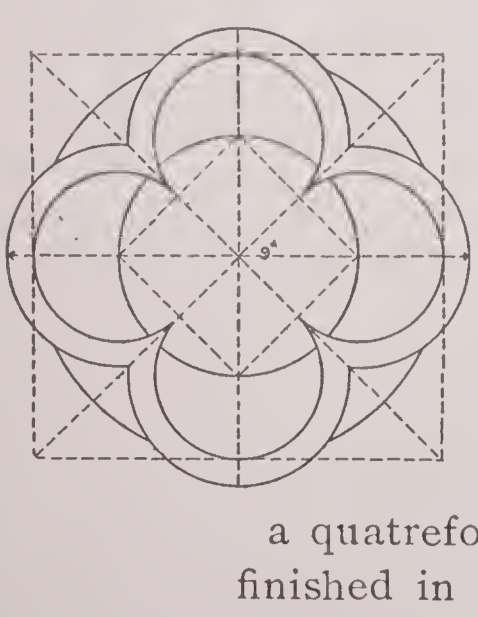
## THE DRAWING OF EASY, ARTISTIC DESIGNS

It must not be thought from the preceding problems that all drawing with instruments is tedious and mathematical, for much of it, especially architectural drawing, shows many beautiful designs and constructions drawn wholly with instruments.



A few figures of this sort are given in the following plates to give further practice in the use of instruments and to show how pleasing in appearance a purely mechanical drawing can be made.

The first design is called a trefoil, and is often used for ornamental window-frames in the gables of churches and similar buildings. The dotted lines show that its general outline is based upon an equilateral triangle. Only the radius of the outside arcs is given, the learner to find the other dimensions by comparison, or he may exercise his ingenuity in modifying the design. The dotted lines should not be inked, but erased from the finished drawing.

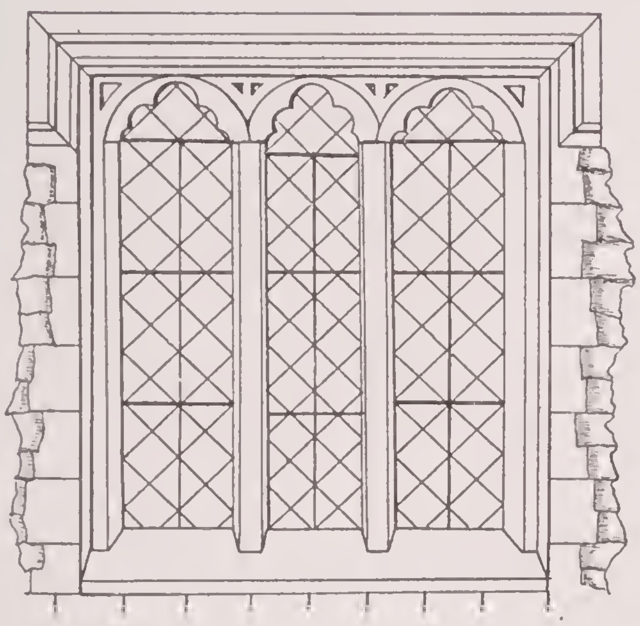


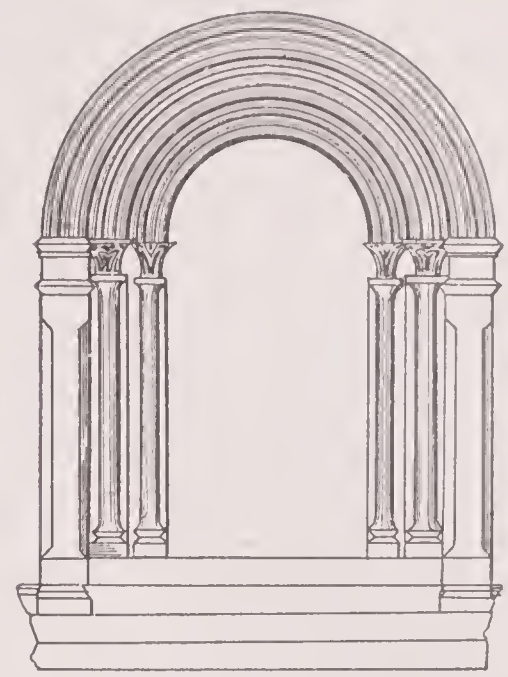
The next figure is also a window-frame design, called a quatrefoil. It should be of the same size in outside dimensions and finished in the same manner, differing only in having four series of curves and being based upon a square.

These two figures will be sufficient for a plate.

The next plate consists of drawings of a latticed window and an arched doorway.

The window should be drawn 6 inches wide and $6\frac{1}{4}$ inches high, the other dimensions being in the same proportions. This figure will afford good practice in the use of the 45-degree triangle and in drawing lines of different widths. It should be first penciled in complete,

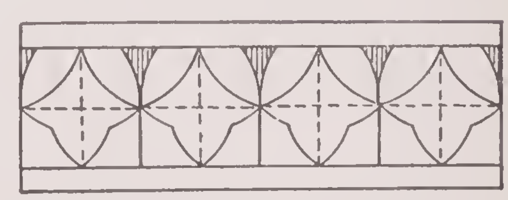


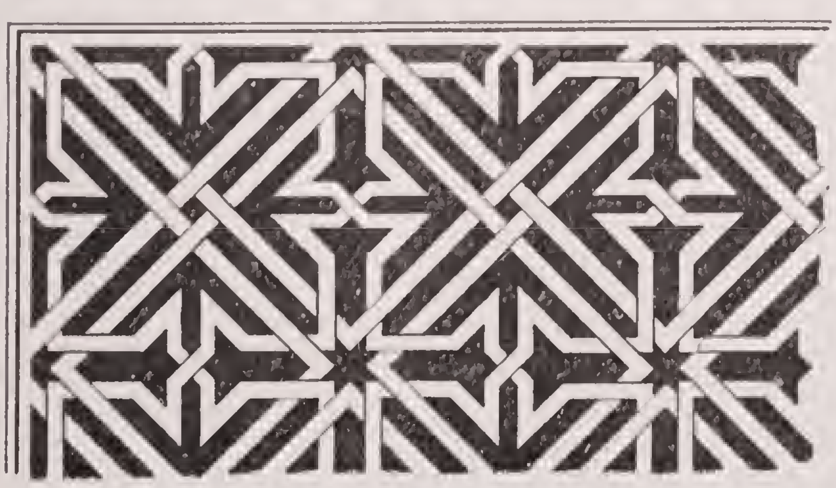


and then, if no errors have been made in construction, inked with T-square, triangle, and compasses. The rough stonework at the sides may be inked free-hand, with a fine writing-pen.

The drawing of the arched doorway affords practice in drawing a large number of circles from the same center. Great care will need to be taken in order not to tear the drawing paper with the needle-point of the compasses. This figure also gives further practice in drawing curved lines of varying widths with the compasses.

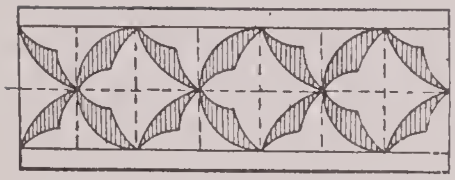
The broken lines at the right and left of the steps show that they may be continued to either side as far as may be necessary.



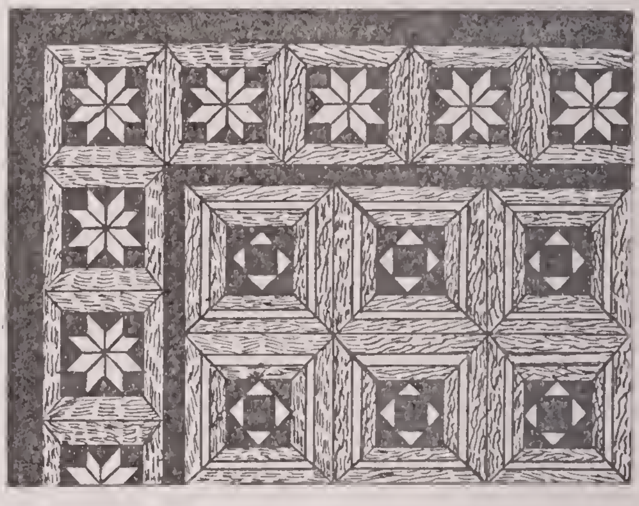


The next sheet of architectural designs shows two forms of trefoil molding, or border, and two of marquetry, or inlaying. Place the first molding, or upright trefoil, at the upper left-hand corner of the plate, and below it the interlaced marquetry design. In drawing the latter, great care must be taken to guard against blotting when filling in the solid black. Each

solid figure should be outlined with the ruling-pen and filled in with an ordinary writing-pen, or a very small camel's-hair brush.



At the right-hand side of the plate, draw the second trefoil design for the upper figure, taking care to place it at the same height as the first. In lining the shaded portions of this design, be careful to make the lines perfectly uniform in width and spacing.

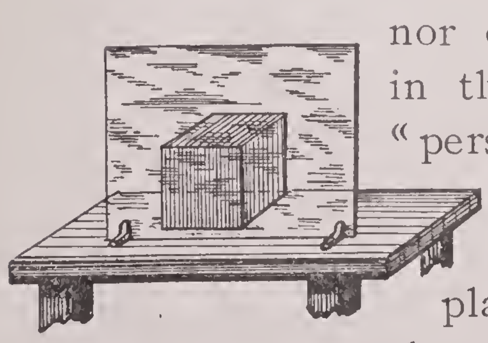


The last figure on this plate shows how pleasing a design may be made by artistically arranging triangles with squares and other quadrilateral figures formed of straight lines only. It affords good practice with T-square and triangles, in inking solid areas, and in shading by broken lines.

## WORKING DRAWINGS—PROJECTIONS

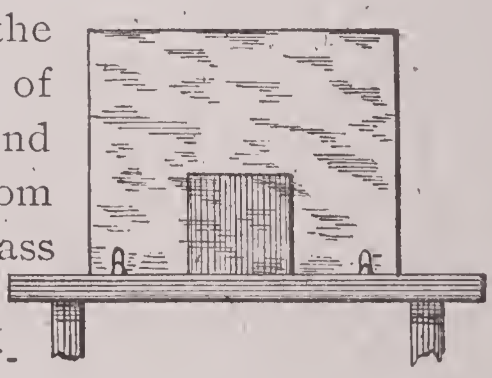
A WORKING drawing is one which will give to a workman all the knowledge of an object necessary to construct it.

For example, a photograph may tell a workman exactly what a finished object looks like, but it would be almost useless as a guide to the making of another like it, since it shows no dimensions, nor does it show of equal length in the picture lines which in the object itself are really equal. The photograph is a « perspective » view — a method of drawing which will be explained further on.



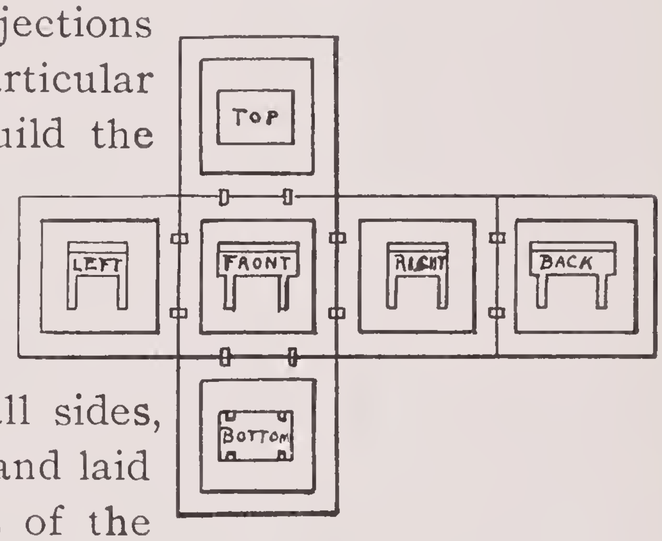
The working drawing, then, must represent upon a plane surface the true form and size of an object, in such a way that it can be correctly built from the drawing alone, without any spoken or written directions.

If we place a cube upon a table and look at it from such a point as to see three of its faces, the image upon the eye is a perspective. If we then place a pane of ground glass upright in front of the cube and mark upon the glass where the ray of light from each visible corner of the cube seems to pass through it, we should, by joining these points by straight lines, have upon the glass a perspective drawing of the cube which, for purposes of making, would be as useless as a photograph.



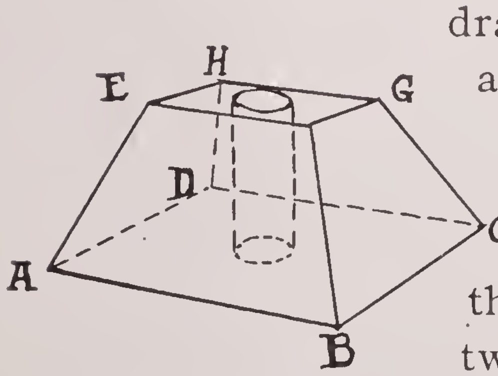
However, if we have placed the pane of glass parallel to the front face of the cube and then move the eye until it, too, is directly before both glass and cube, we shall see a square outline in which each dimension of the cube has its correct proportions. If we imagine the eye moved back to a very great distance, the rays which pass to it from the four visible corners of the cube will pierce the glass perpendicular to its surface, and the apparent image on the glass will have not only the correct shape, but the correct size as well. This image, formed by lines supposed to fall perpendicularly upon an imaginary transparent plane, is called a projection; sometimes an "orthographic projection."

If, now, we were to place another pane directly above the cube, and a third at one side of it, and receive projections upon them, we should have three views (in this particular case all alike), from which any workman could build the cube without any further explanation.



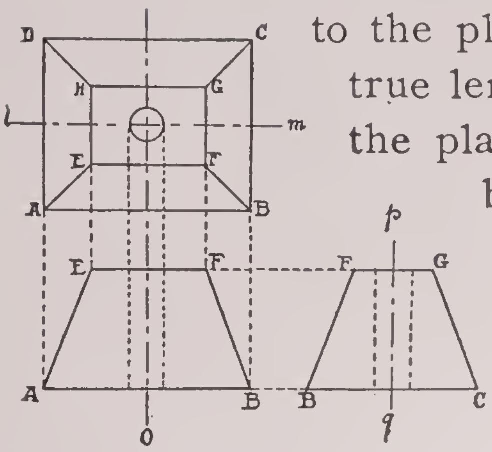

In more complex objects, it is sometimes necessary to use more than three views. Let us suppose, for this purpose, that our object, a table, is suspended in a glass case which surrounds it on all sides, and which is so hinged that it can be opened out and laid flat like a sheet of paper. If the different surfaces of the table are parallel to the glass sides, and we place our eye on each side in succession, we shall see the front side from in front, the top from above, the bottom from below, the right from the right, etc. When the glass case is opened out, it will then give the correct arrangement of projections upon the sheet; that is, the front view or "front elevation" will occupy the center, the "top plan" will appear above it, the right end-view at the right, etc. If a back view, or "rear elevation," is necessary, it should be placed at the right of the right end-view, and if a bottom view, below the front elevation. With this arrangement, the position alone tells at once the point from which the view was taken.

From what has already been said, let us try to make a working drawing of such a piece as is here represented, a spacing block, which is a frustum of a pyramid with a hole through its middle.




If we consider the face EAB the front, then GCB will be the right end; and, since the front and back views are alike, and also the two end-views, we shall need but three projections — front elevation, plan, and one end-view — to completely represent the object. Arranging these three views in the way already

described, we have the working drawing here shown in which each part of the object appears with its proper dimensions, or in such a manner that those dimensions may be readily found. For example, all lines except the corners of the pyramid (as EA, etc.) are parallel to the planes upon which they are projected, and appear in their true length; the diameter of the central hole is clearly shown in the plan, and even the length of any corner line may be found by computation, if for any reason it is desired. It would not be necessary, in the construction of the object, for the vertical height will answer the purpose equally well.

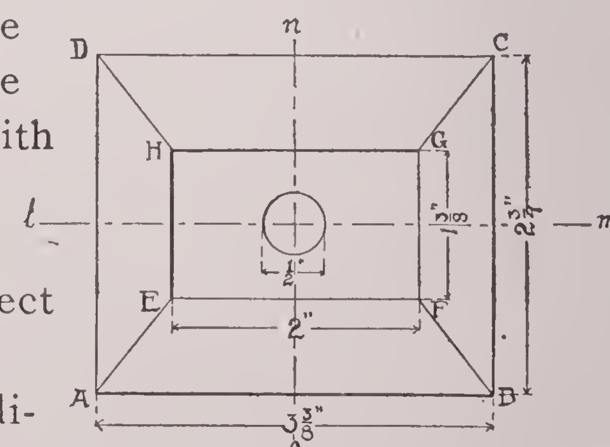



In the actual construction of such a drawing, first draw the broken center lines *lm*, *no*, and *pq*. In the front elevation, lay off on *no* the height of the frustum, and on each side of the center line, at the base lay off one-half of the length of AB, also the radius of the central hole. At the top of the frustum, lay off one-half of EF, on each side of the center line. Draw the lines AB, EF, EA, and FB, and the dotted lines representing the outlines of the central hole, and the front elevation is completed.

In the plan, draw a circle representing the central hole, using the intersection of *lm* and *no* as a center. Lay off on each side of *lm*, one-half of DA, HE, GF, and CB, having first found the location of these lines with reference to *no*, by "projecting up" the lengths of AB and EF from the elevation, as will be readily understood.

In the same manner, the height of the end view may be found by extending by dotted lines the lines EF and AB of the front elevation. The lengths of FG and BC being the same in the end view as in the plan, one-half of each may be laid off from the center line *pq*, also the radius of the central hole, and the end view, or "side elevation" as it is sometimes called, completed in the same manner as the front elevation. Our first *working drawing* is now ready to ink.

In making drawings of large and complicated machines and structures, it is, of course, impossible to make every view of the object as large as the object itself; therefore they are made with each dimension of the drawing one-half, one-quarter, one-eighth, etc., as large as the corresponding dimensions of the object itself.




In order to indicate this, the actual dimensions of the *object* are given upon the drawing, and the *scale* of the drawing is given below. For example, the plan view of the pyramid shown in the previous working drawing is here redrawn and dimension lines added, the scale being one-

half size; that is, each line in the drawing is one-half as long as the corresponding line of the object is to be made, while the sizes given on the dimension lines are the same as they are to be made in the object.

When the scale is "half-size," a dimension of one foot in the object will be represented in the drawing by a line six inches long; hence the drawing is lettered: Scale, 6″ = 1 ft. In like manner, when the scale is "quarter-size," it is expressed thus: Scale, 3″ = 1 ft.

For convenience in making scale drawings, scales are made on which distances of one inch, one and one-half inches, three inches, etc., are divided into twelve equal parts, and each of these twelve parts is again divided into halves, quarters, etc., so that the reduced dimensions can be read directly from them, as readily as from a full-sized scale.

It is the practice of the best shops never to "scale" a drawing; that is, never to measure on a drawing a line whose dimension is not given. This is because a workman is more apt to make an error in measurement than is a skilled draftsman, and also because most drawings are copied by a photographic process called "blue printing," in which the print shrinks slightly on account of being wet to develop it. For these reasons, the draftsman should use extreme care to place upon his drawings, in plain figures, every dimension necessary for the accurate construction of the object represented.

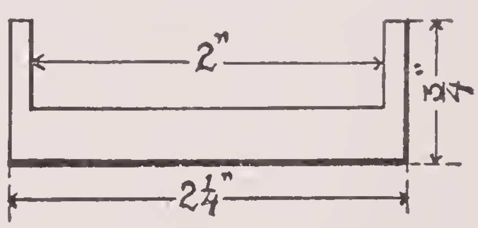


Fig. 75

Dimension lines should be light, solid lines, extending between the points measured from; and their ends should be marked by arrow-heads, thus: Figure 75. Dimensions should never be marked on a line of the drawing itself, but to one side; the points between which the measurement is taken being joined to the arrow-points of the dimension line by short dotted lines, as shown in the lower part of the figure.

Fig. 77

All figures should be very plainly written, and when fractions of an inch are used, the line separating numerator and denominator should always be horizontal, thus: $\frac{11}{16}$ inches. If slanted thus: $^{11}/_{16}$ inches, it may be mistaken for $1\frac{1}{16}$ inches, and costly errors be made in the shops.

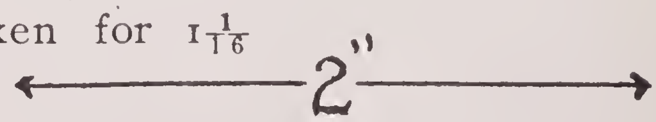


Fig. 76

Dimension figures should always be written at right angles to the dimension line, thus: Figure 76, and never thus: Figure 77. Dimensions should be given in inches only, up to 24 inches, since a workman usually measures with a two-foot rule. Larger dimensions should be given in feet and inches, thus: 7 feet 8 inches. When very small dimensions must be given, and there is not sufficient room to write the figures across the line,

the arrow-points may be faced inward and the dimension written at one side, thus: Figure 78. The arrow-points should be uniform in length and slant; about 30 degrees. For practice in projection drawing, two plates of figures, affording practice in the rules just given, are here inserted. Neatness and accuracy should be the motto, as with the geometrical constructions; especial pains being taken with the lettering and the figures of the dimensions. Before trimming the plate, the young draftsman should go carefully over each figure and ask himself: "Have I shown enough in my drawing so that I or a workman could make each object represented, without any further instruction than my drawing gives?"

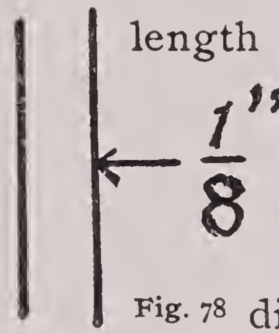


Fig. 78

Figure 1 of the first plate shows three views of a rectangular prism. Figure 2 shows corresponding views of a triangular prism, or wedge. Notice that but for the plan, Figure 2 could not be distinguished from Figure 1. Figure 3 represents a triangular prism of a different shape. Here the end elevation makes clear the difference in shape.

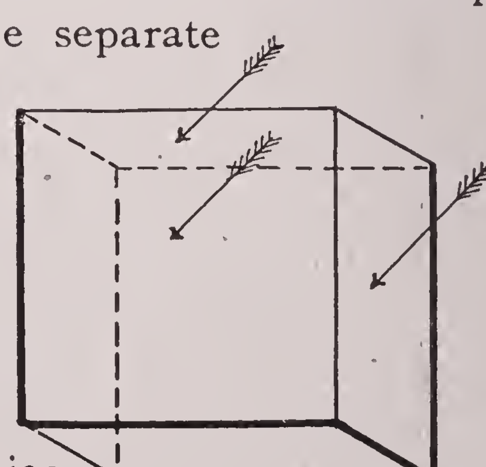
Figure 4 shows plan and front elevation of a cylinder. Two views represent this object as fully as three, since the side elevation will of course be exactly like the front. Figure 5 represents a hexagonal prism and Figure 6 a hexagonal nut.

Figure 1 of the second plate represents in side elevation a blow-off cock for a boiler. This one view would not be sufficient to enable a workman to construct the object.

Figure 2 shows three views of a bolt or pin with a split cotter, and Figure 3 a side elevation of a plate coupling for two lengths of shafting, fastened together by six bolts having hexagonal heads and nuts.

## SHADE LINES AND SURFACE SHADING

Shade lines are lines used to give a clearer and more finished appearance to a drawing. They always indicate separate planes, one of which is in the light and the other in the shadow.



When drawing, a draftsman usually arranges the light so as to fall over his left shoulder upon the drawing, and in determining shade lines the light is always considered to strike the object from the left and above, at an angle of 45 degrees to each plane of projection. For example, on the cube shown above there are three lighted surfaces and three in shadow; so that on the edges of the three visible planes there will appear four shade lines.

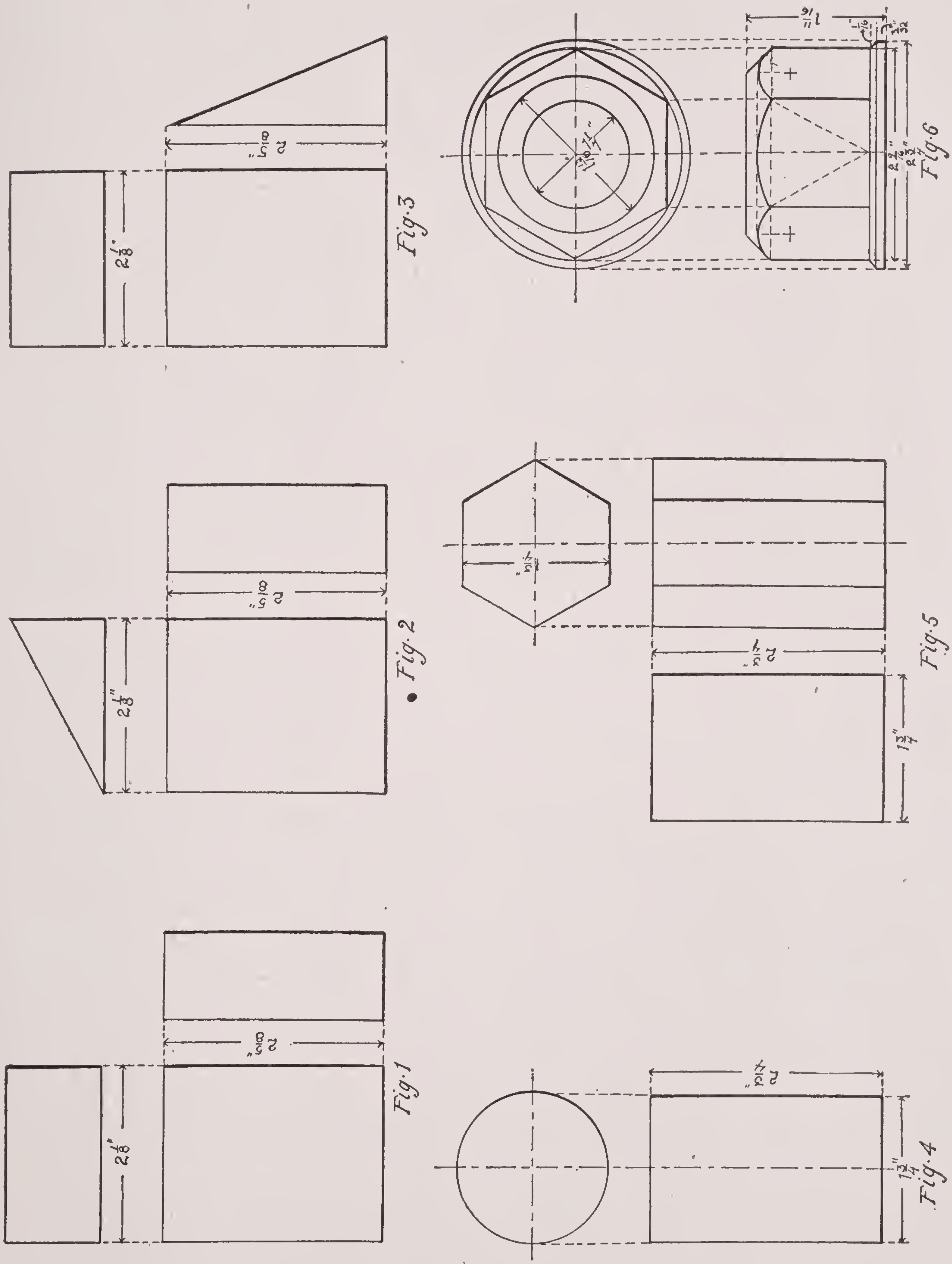



PLATE I

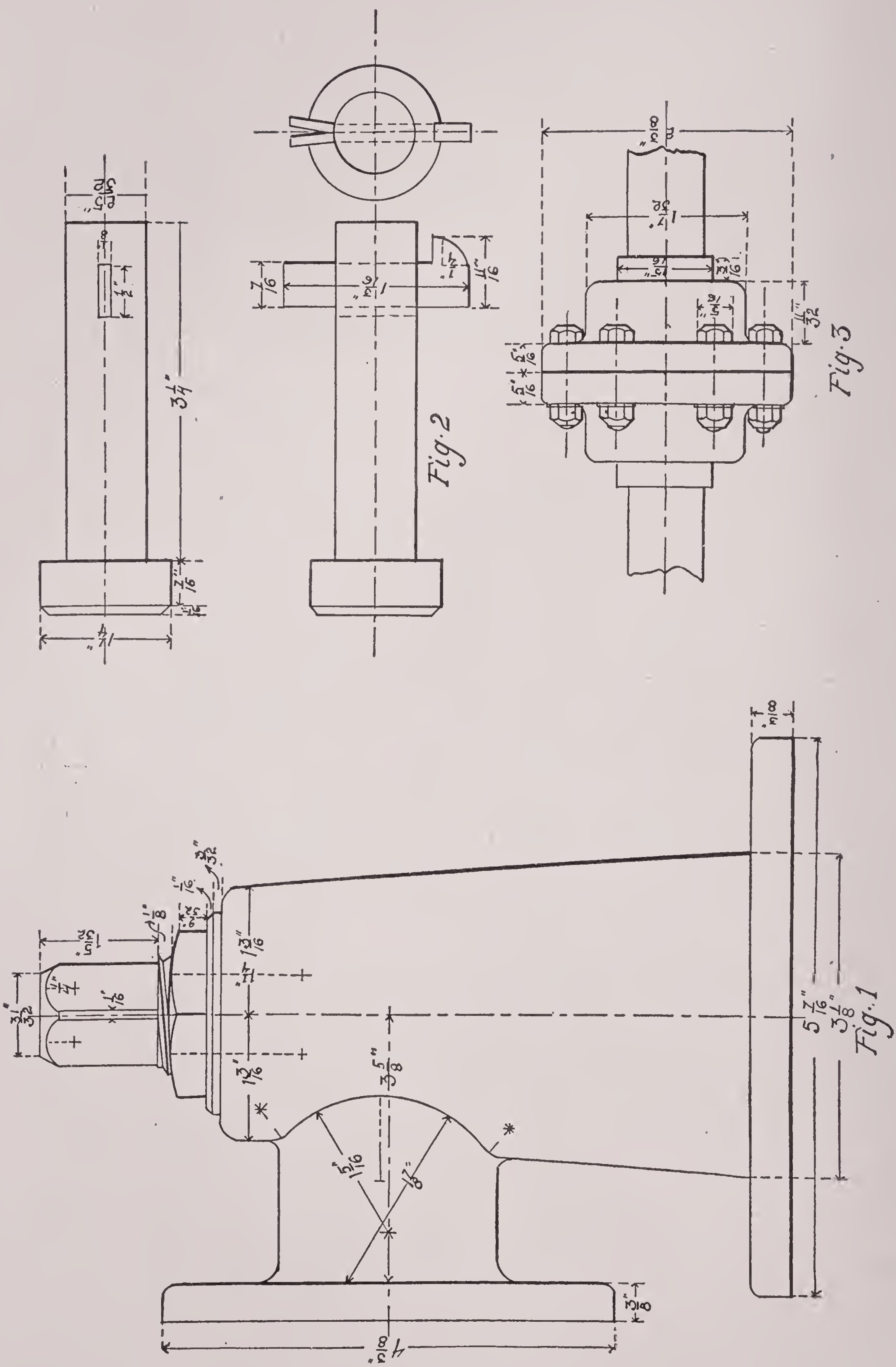
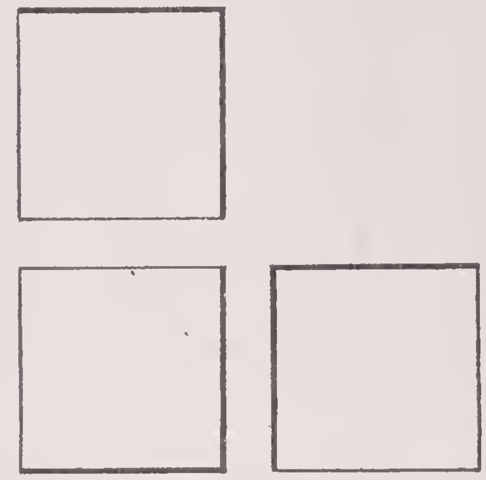
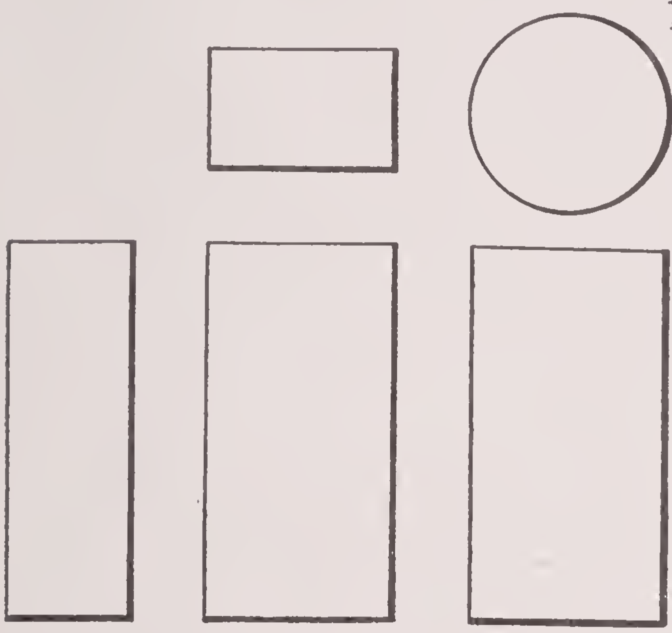



Plate II

According to this theory, we should have the three projections of a cube shaded as shown in the margin, but some of the best draftsmen simplify the rule for shading by placing shade lines at the right side and bottom of all projecting parts in each view; thus considering each plane separate and not as folded back from a position surrounding the object.



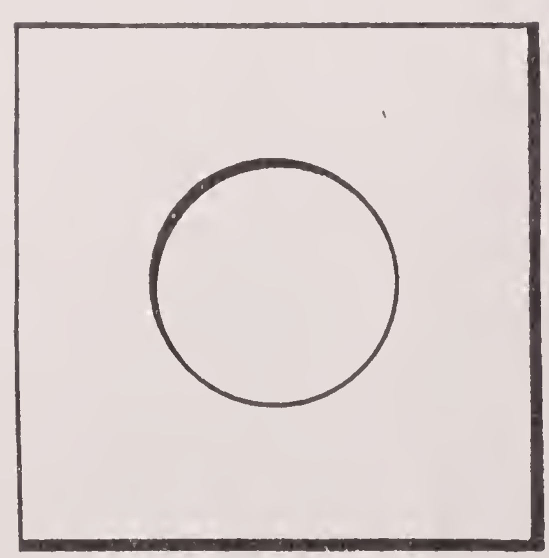
The practice last described, even though not theoretically correct, is more easy to apply, and it will be the one followed hereafter. Besides, it gives to each view a more natural appearance than when shaded as would be required by theory. In shading a cylinder, it is usual to shade the right and bottom, although the line or «element» of the cylinder which separates the lighted from the shaded portion is not at the right-hand side; neither would a shade line be required the entire width of the base.



The rules for shade lines will be best remembered by means of a few examples:—

The three views of a rectangular prism are to be shade-lined as in the margin, at the right and bottom of each view.

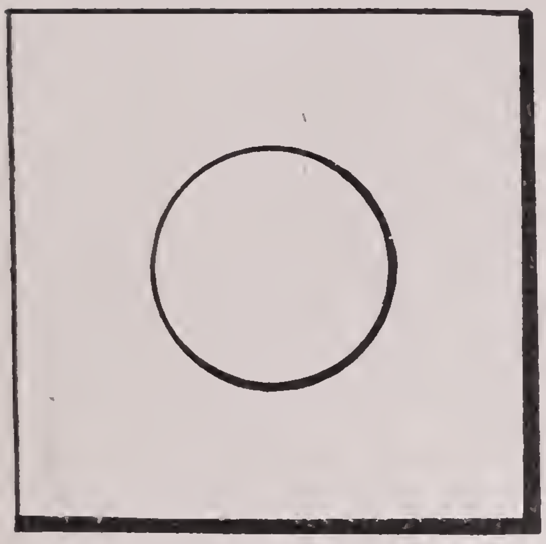
In shade-lining a cylinder, the right and bottom of the elevation are shaded, as explained above. In the plan, first draw the circle light; then, without changing the radius or adjustment of the pen-points, move the needle-point to a new center downward and toward the right at an angle of 45 degrees, and draw a semicircle which will thicken the circumference most at the lower right-hand side (what corresponds to southeast on a map), and vanishes into the light line at the upper right-hand and lower left-hand sides.



In shade-lining a circular opening, the line separating the lighted and shaded surfaces is, of course, at the opposite side of the circle, and for this reason, the upper left-hand (northwest) side of the circle is shaded.

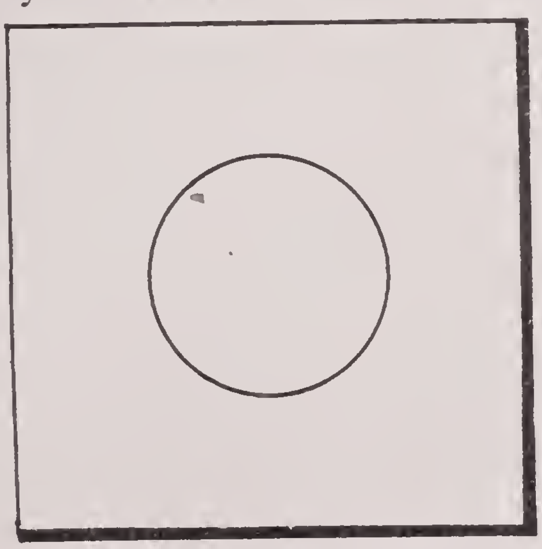
By comparing the figure at the bottom of this page and that at the top of page 4008, it will be noticed at once that the first represents a square object with a circular hole through it; for example, a square nut, while the second has, instead of a hole, a circular boss or projection.

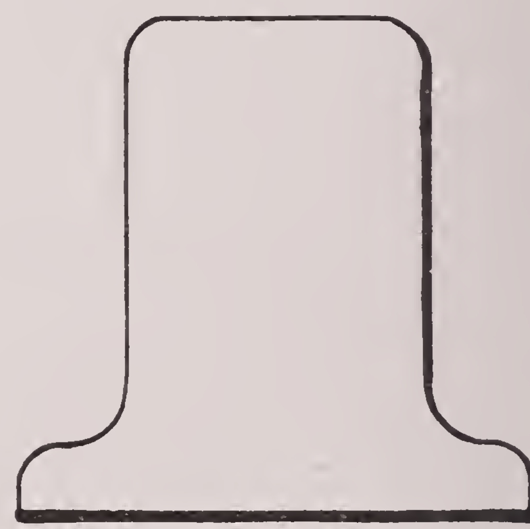
If the circle were not shaded at all, as in the third figure, it would indicate that the circular hole was filled by a separate piece even, or "flush," with the surface of the outer square.



When an arc joins two straight lines, one a shade line and the other not, it should gradually decrease in width from the shaded to the unshaded line, which may be done by shifting the needle point of the compasses as in shade-lining circles. In this case, however, the center should be shifted either horizontally or vertically, and not at an angle of 45 degrees, as will be seen in the marginal figure representing the pedestal of a machine.

Since drawings should never be scaled, it matters very little whether the added thickness of the shade line is inside or outside the measured dimensions of the drawing. Many draftsmen use no shade lines in drawings of parts of machines, adding them only in views of assembled machines.

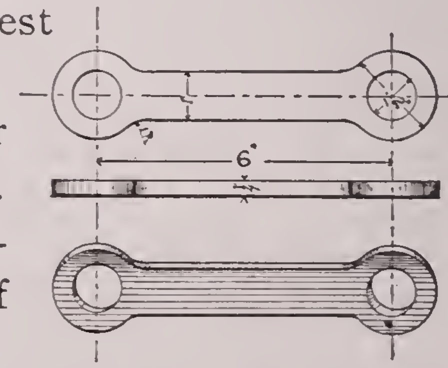




Shade lines should be about double the width of other lines of the drawing and should always be full lines. Never attempt to shade dotted lines.

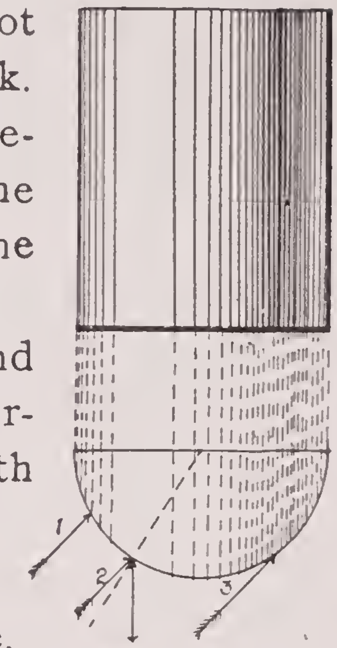
## SURFACE SHADING

Very little need be said of surface shading, since it is less and less used by the best draftsmen. Perhaps the best direction is: — "Don't." But where it seems desirable to shade a surface, for the sake of greater clearness, it should never be done free-hand. For plane surfaces, use fine, parallel lines, increasing the distance between them on that portion of the surface supposed to be most highly lighted.

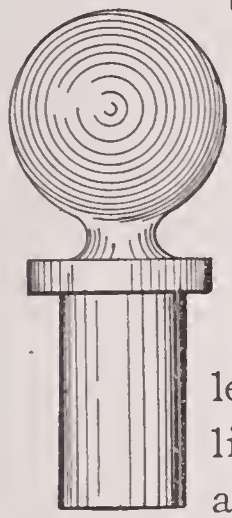



In line-shading cylindrical surfaces, the spacing of the lines may be to some degree found by drawing a half plan of the cylinder,

dividing its semi-circumference into equal parts and projecting these points upon the elevation. The most highly lighted part of the cylinder will be that indicated by the arrow 1, but it will not appear so, since the light striking it is reflected directly back. The part appearing lightest is indicated by the arrow 2, because at that point the light is reflected directly toward the eye. The darkest part of the cylinder is indicated by the arrow 3.

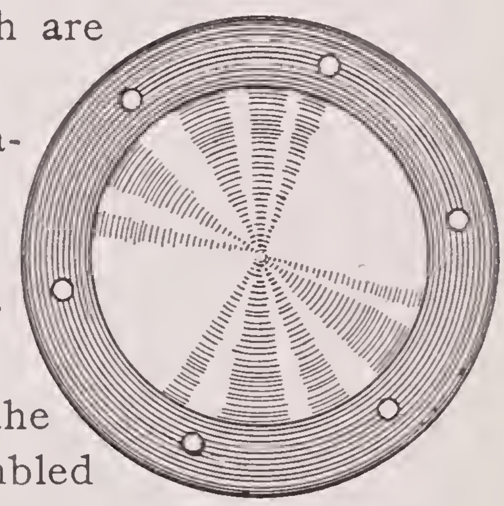


Now, while the spacing of the shade lines is readily found in the manner shown, their width is not so readily determined, and will always be a matter of practice and taste with the draftsman himself.



A sphere is shaded by circles — concentric with each other but eccentric to the outline of the sphere, the center of the shade circles being located at the lightest part of the sphere. The innermost shade lines are usually not complete circles.

Polished disks are shaded by short arcs decreasing in length toward the center. The ends of the arcs may be limited by means of penciled radial lines, which are afterward erased.

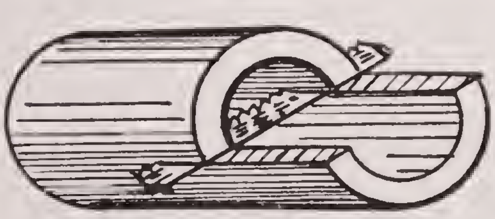


Fine examples of shading may be found in trade catalogues, and by noticing the actual effect of light in photographs and half-tones of machinery, or upon the machines themselves, much more natural and artistic effects may be produced than by following any set rules.

It is to be remembered that shading adds nothing to the accuracy of a drawing, and it is best used only in assembled machines, to help those unaccustomed to the reading of working drawings more readily to understand the object represented.

## SECTIONS

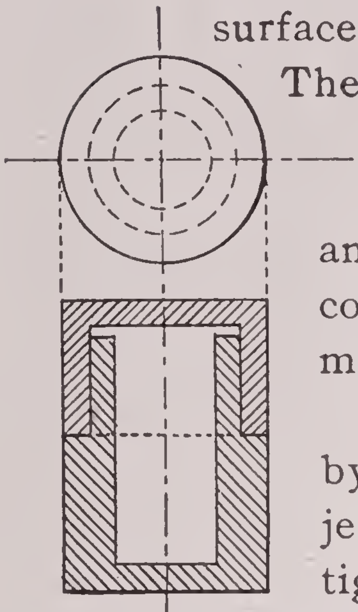
It often happens that all the possible outside views of an object fail to show enough to enable a workman to build it. Whenever



it is necessary to show the inside structure of machines, etc., the thickness of metal, or the kind of material used, it is best shown by considering the object cut across, as by a saw, on any plane convenient to best show what is desired.

For example, if we had merely an elevation and plan of a short piece of pipe, it might be difficult to tell, in an unshaded drawing,

whether the object was hollow or filled with a core of some different material. If cut, however, the empty pipe shows only the outer wall in section, while the inner hollow will, of course, show no roughened surface.



The usual way of showing a section is by means of parallel lines, drawn usually at an angle of 45 degrees, though if many parts are shown touching each other, the 30-degree and 60-degree triangles may also be used, for no two parts in contact should be section-lined in the same direction, else they might be mistaken for a single piece.

In the present figure, it is easy to see by means of two views only, that the object represented is a circular box with a tight-fitting cover.

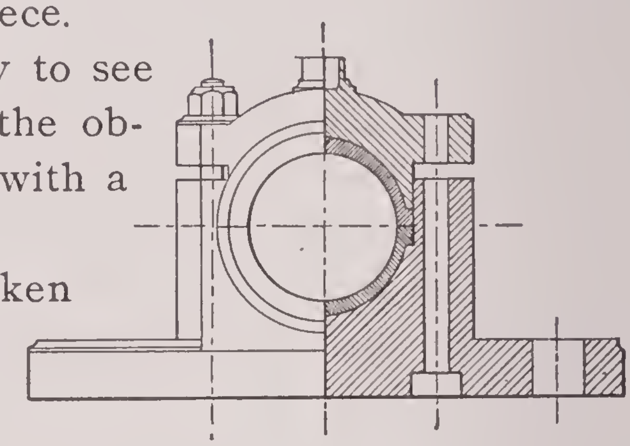


Fig. 94

The plane on which a section is taken should always be indicated by a dot and dash line, lettered or numbered, thus: A — · — · — · — · — · — B, and the section itself should be lettered thus: Section on AB.

Much time is often saved where the two sides of an object are alike, by drawing one side in elevation and the other in section, thus Figure 94.

In this figure is also seen the manner in which different metals may be represented in section. For this purpose a system of section-lining is used which is represented in the following figures, Figure 95.

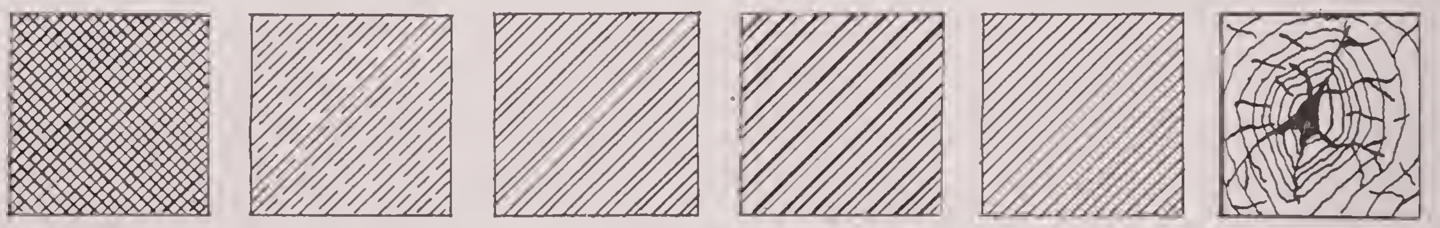
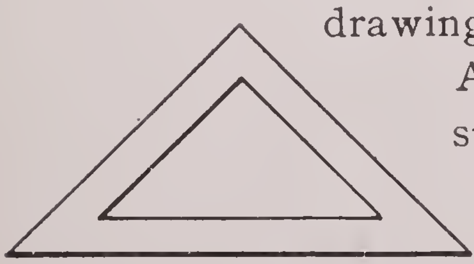


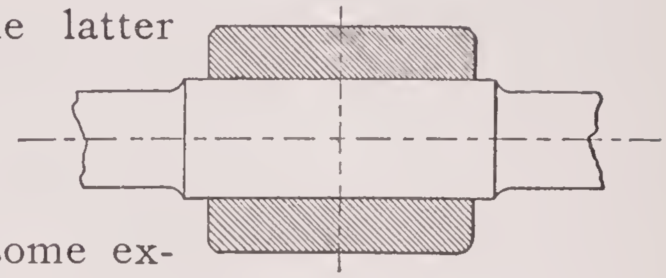
Fig. 95

Formerly, most finished drawings were tinted with water colors to show the material used for each part, but as this could not be reproduced in blue prints, the system of lining has taken its place. Tinting is now little used except in mapping and finished architectural drawings.



A convenient and easily made arrangement for section line spacing is a small triangular piece of thin wood fitted in the opening of the 45 degree triangle, leaving just enough space at one side so that the triangle may be moved sidewise the distance between two section-lines. With a little practice, the inner triangle may be held with one finger, the 45 degree triangle moved against it to draw a section-line, the inner triangle again

moved to the opposite side of the space, and the outer again shifted against it, thus spacing the section-lines equally by a step-by-step movement of the two triangles. To look well, section-lining, or "cross hatching," as it is sometimes called, should be perfectly uniform in spacing and thickness of lines, and the latter should not be too light.



Although in drawing a sectional view, we assume that the object is cut on a certain plane and all in front of that plane removed, there are some exceptions, in ordinary practice. For example, when a pulley, coupling, or machine frame is shown in section parallel to the center of shaft, or through the center of bolts or other fastenings, the shaft and fastenings themselves are not sectioned.

## DRAWING ELEMENTS AND DETAILS OF MACHINES

We are now prepared to make working drawings of machines; but in this work it is best to learn first how to draw rapidly and well those parts or details which are common to all kinds of machinery. Among the most common details are bolts and screws, and since it would take unnecessarily long to show each screw-thread as a true helix, it is usual to employ some easy, common, and "conventional" way, understood by all draftsmen and workmen, of showing these often repeated parts.

Figures 1 to 8 (Page 4012) show methods of drawing different kinds of screw-threads, or of representing simply that a part is threaded.

Figure 1 represents a "single" square thread, the diameter being $1\frac{1}{2}$ inches and the pitch $\frac{3}{8}$ inch. By a single thread is meant that but one helix winds round the bolt. This thread will be easily drawn after noticing that its depth is equal to its width, and that the top of the thread on one side the bolt is opposite the bottom on the opposite side. The dotted lines near the top show the hidden portion of one turn of the thread. Of course, the edges of the thread are straight from side to side, instead of being parts of a true helix.

Figure 2 is similar to Figure 1, except that the thread is a double one, two helixes being wound side by side around the bolt. This brings the top of a thread on one side opposite the top of the next thread on the other side of the bolt.

Figure 3 represents a single V thread, the angle of which is 60 degrees. The pitch is $\frac{1}{7}$-inch, or, as it is usually expressed, 7 threads to the inch. In drawing the thread, draw the outlines of the bolt $1\frac{1}{4}$ inches apart, and then opening the dividers to $\frac{1}{7}$-inch (which

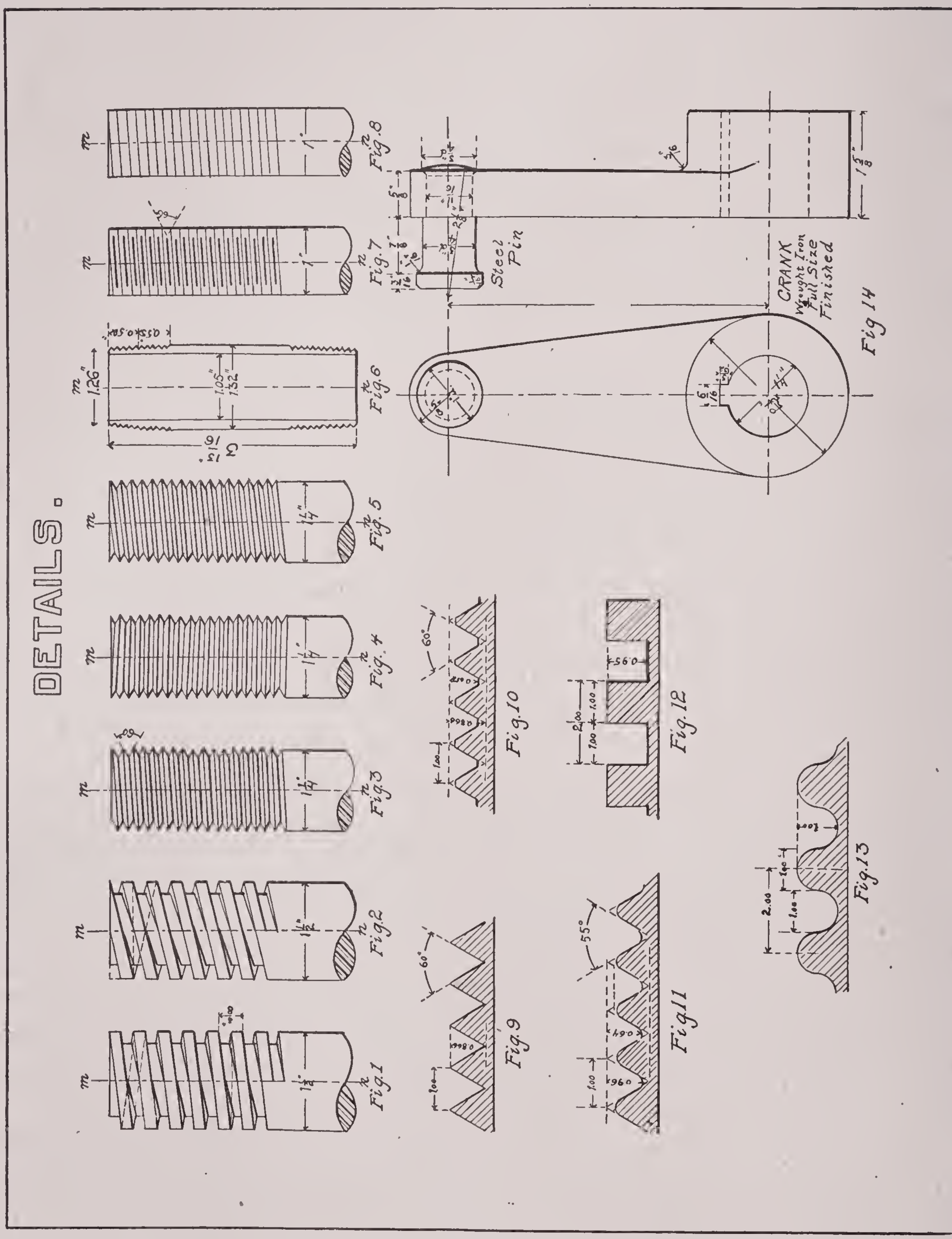

DETAILS.
Fig.1
Fig.2
Fig.3
Fig.4
Fig.5
Fig.6
Fig.7
Fig.8
Fig.9
Fig.10
Fig.11
Fig.12
Fig.13
Fig 14
Steel Pin
CRANK
Wrought Iron
Full Size
Finished

Plate III

may be found by trial), step off the points for the tops of the threads on each side, taking care that the top of the V on one side is horizontally opposite the bottom on the other side. Now with the T-square and 30-degree triangle, draw short, parallel lines from each spaced point toward the center of the bolt. By reversing the triangle and drawing short lines to intersect the first, the sides of the thread will be outlined. Join the tops of these V's on opposite sides with heavy, or shaded lines, and the bottoms by lighter lines.

All the threads described thus far are « right-hand »; that is, the nut is screwed on by a right-hand turn, in the direction of the hands of a clock. In drawing the V thread of Figure 3, care must be taken to make it right-handed, and a single thread, as in this way only is it distinguished from the « left-hand » thread of Figure 4, and the double V thread of Figure 5.

Figure 6 is a longitudinal (lengthwise) section of a short piece of threaded brass pipe. Such a piece is usually called a nipple, and it will be noticed that the thread tapers so that when screwed into another fitting, or « made up » as it is termed, the thread gradually tightens so that steam or water will not leak along it. Piping is sized by its inside, instead of its outside, diameter, and is always slightly over the size by which it is known, so that the article represented by Figure 6 would be known as a 1-inch brass nipple. The *real* inside and outside diameters are usually given in manufacturer's tables. The material is shown by the section-lines.

Figures 7 and 8 are still more rapid ways of representing screw-threads. Unless the need for haste is very urgent, Figure 7 is to be preferred.

Figure 9 is a section of a V thread showing its proportions. Its angle is 60 degrees and its depth 866-thousandths of the pitch; that is, if the pitch were 1 inch, the depth would be 0.866 inch.

Figure 10 shows a modified form of V thread known as the Franklin Institute, or United States standard thread. The angle is the same as the V thread, but $\frac{1}{8}$ of the height of the thread is removed from both top and bottom, leaving its height about 65-hundredths of the pitch. This form of thread has almost entirely replaced the V thread in the United States.

Figure 11 shows the English standard thread, known as the Whitworth. Its angle is 55 degrees and the top and bottom are rounded instead of flat, as in the United States standard.

Figures 12 and 13 show the proportions of the square thread and of a special form of round thread often used in screw-presses where a very strong thread is required.

Figure 14 shows front and side elevations of an engine crank, with shouldered pin riveted in and a key-way cut in the hub. The distance

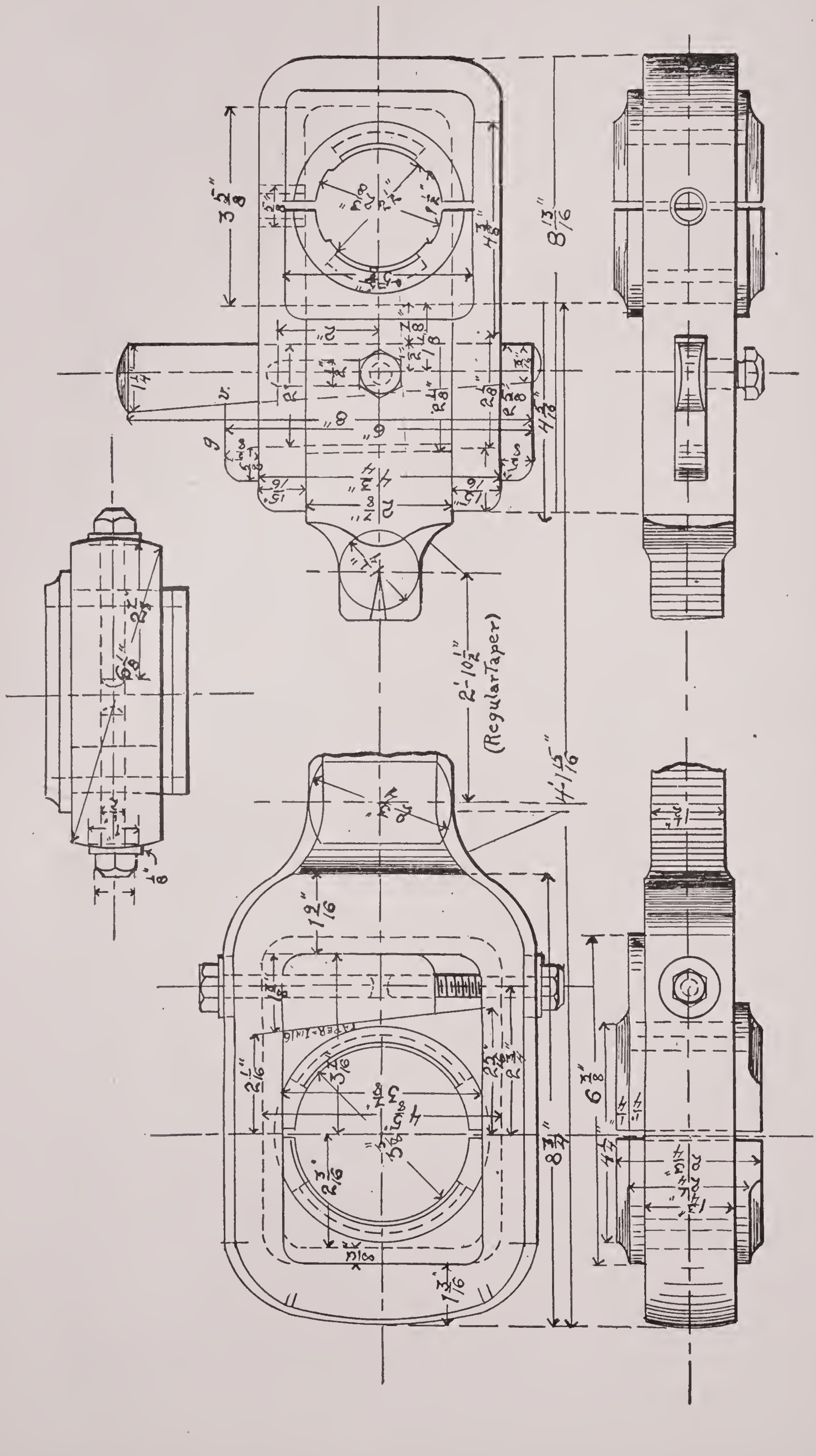



PLATE IV

between the center of the pin and center of the hub, $4\frac{7}{8}$ inches, is the radius of the circle through which the pin turns. The diameter of thi circle is called the "throw" of the crank.

The figures of the next plate show three views of the connecting-rod of a steam-engine. The smaller end is fastened to the wrist-pin of the cross-head and is called a "strap-end," on account of the U-shaped strap passing over its end and holding the brasses in place. The other end, cut from the solid forging, is called a "box-end."

Since the plate is too short to show the whole length of the rod, it is shown broken, the distance between the two ends is given, and the cross-section at these two points is shown cross-hatched. The end view is also shown out of its true position. This plate gives excellent practice in joining curves and straight lines, inserting dimensions, shade-lining, section-lining, and surface-shading.

Plate V shows a half-elevation and a section on the diameter of a large band-wheel with eight arms. Draw center lines first, and draw both views together, so that points found by measurement in one may be projected upon the other. The center lines of the arms are easily laid out from the center with the 45 degree triangle.

The shaded ellipse on the vertical arm shows the cross-section at that point in a manner similar to the two sections of the connecting-rod in the previous plate. The hub and arms are "cored" when the wheel is cast, the hub being cored larger in the center so that it need not be bored its entire length. It also has two key-ways. The holes shown in the arms are necessary to support the cores, and are "reinforced" inside so that the arms need not be weakened at these points.

The face of the pulley is "crowned," or made higher in the center than at the edges, to prevent the belt from running toward either side, while the wheel is in motion. This explains why the elevation is outlined by two semicircles drawn close together.

This plate shows front and side elevations, a vertical central section, and a section of the arm of a spur gear-wheel having fifty-four teeth. The dotted circle midway of the length of the teeth is called the "pitch circle," and is one of the two circles, which seem to roll upon each other when two gears are "in mesh," or one driving the other. Upon this circle is laid off the "pitch" of the teeth which, like the pitch of a thread, is the distance from a point on one tooth to a similar or corresponding point on the tooth next to it.

As has already been explained, the curve of a gear-tooth is usually an involute, though other curves are sometimes used; but since it would take too much time to draw this curve for each tooth, the teeth are laid out as nearly as possible with arcs of circles, as indicated by the dotted arcs at $p$, $o$, etc. If necessary, the true curve of

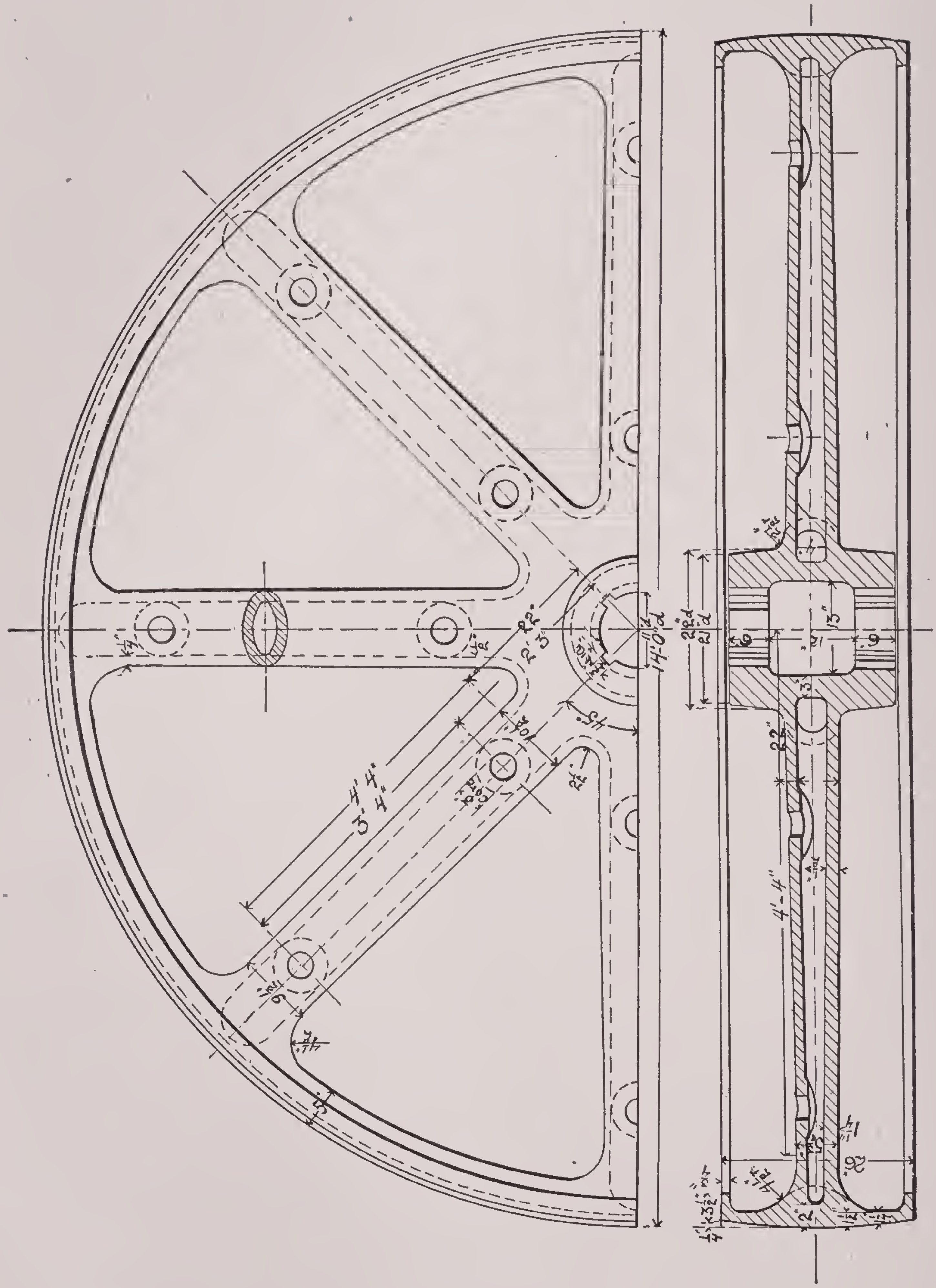


Plate V

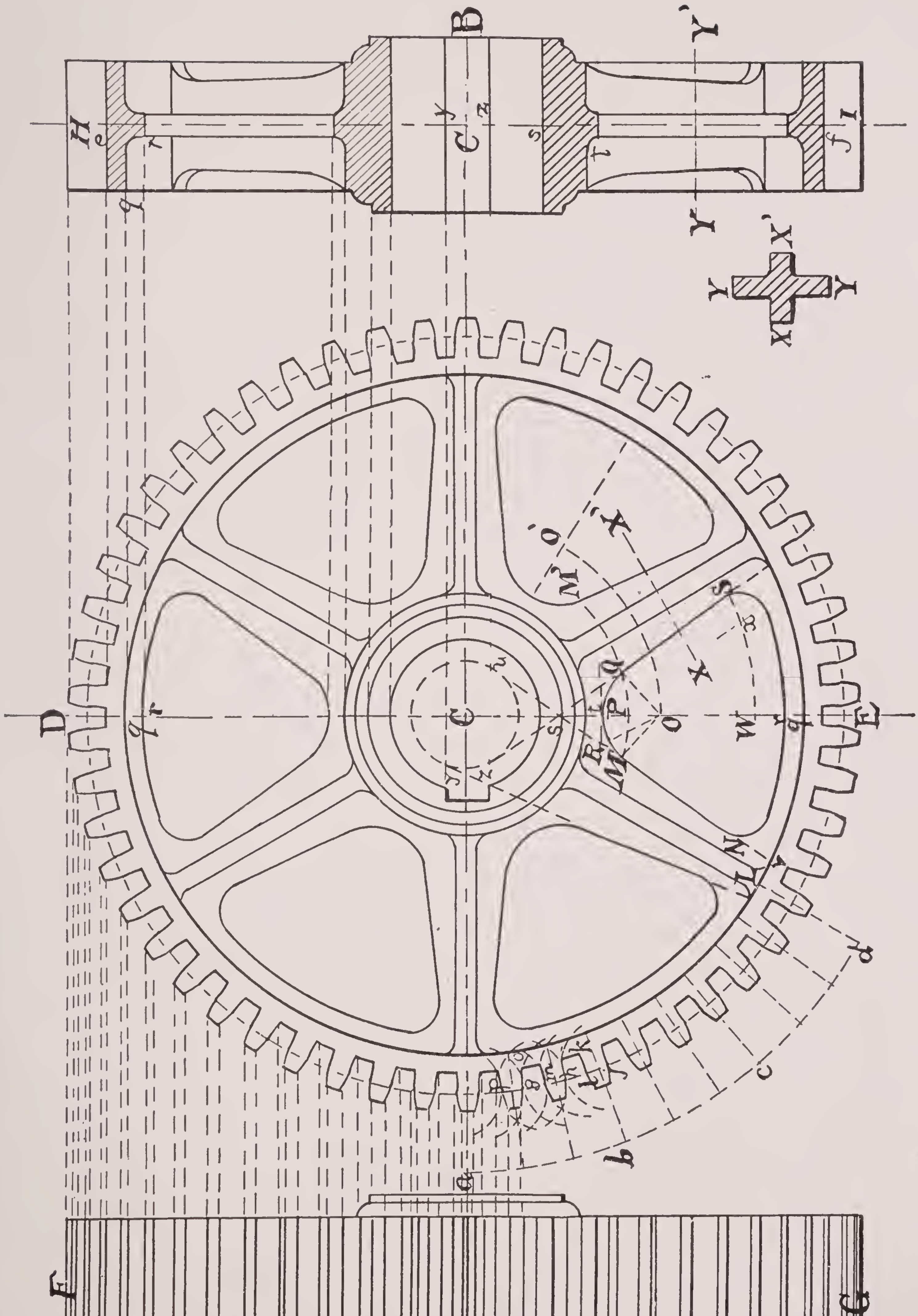
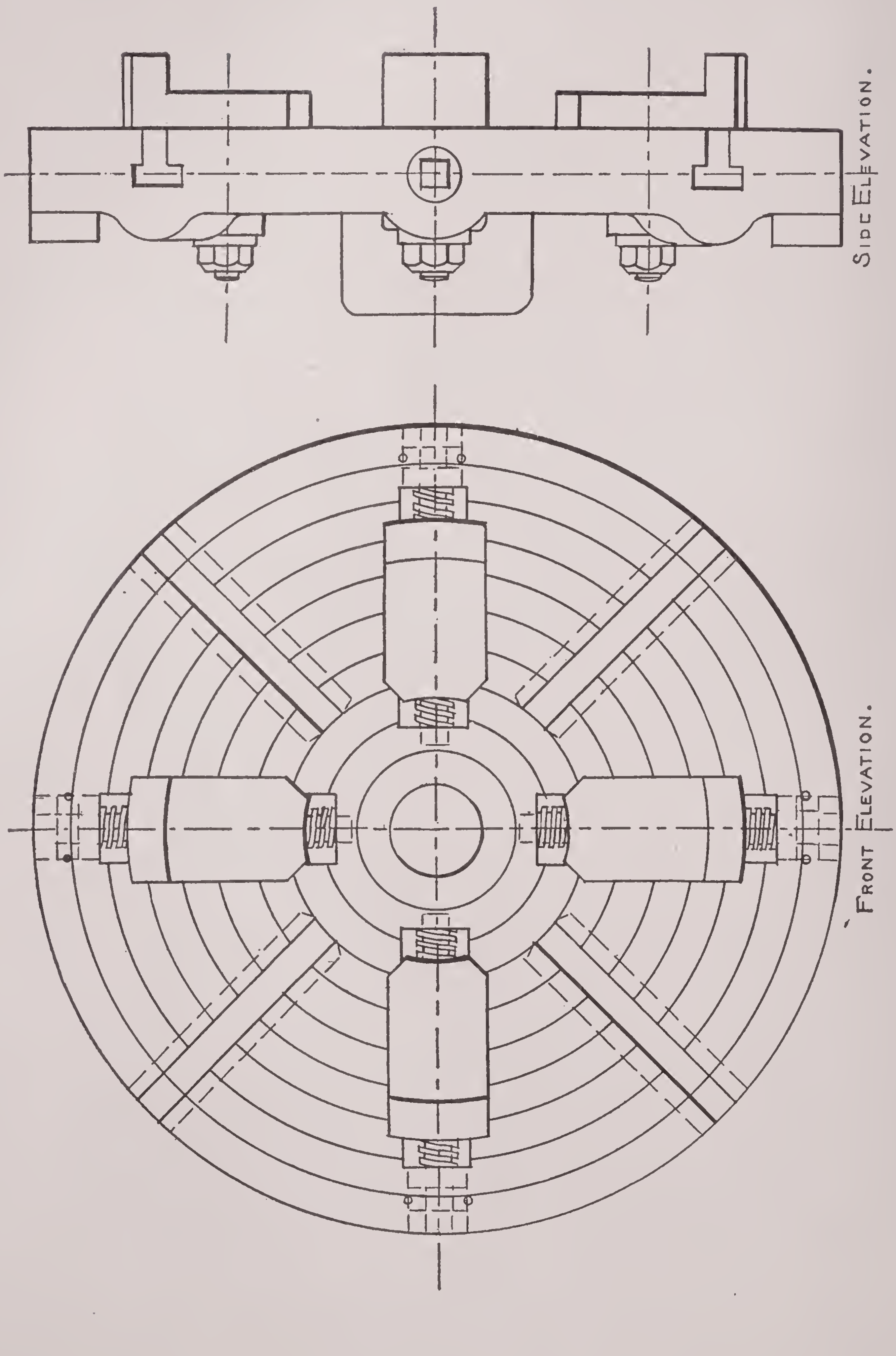


Plate VI




Scale 3 Inches = 1 Foot.

Plate VII

a single tooth is drawn full size for the use of the workman, and the others drawn by arcs whose radii are equal to the pitch of the tooth itself. That part of the tooth curve outside the pitch circle is called the « face,» and that within, the « flank » of the tooth.

Having stepped off the pitch circle into fifty-four equal parts with the dividers, take each point as a center, and, with the pitch as a radius, draw the curves of the face of the teeth, limiting the height by the circle which shows the extreme diameter of the wheel.

In the same manner, swinging the pencil-point to the opposite side of the center, draw the flank curves of each tooth and limit its depth by a second circle inside the pitch circle. If the whole depth of the tooth be divided into seven parts, the outer, or « addendum » circle should be three of these parts from the pitch circle, and the inner, or « root » circle should be four parts from the pitch circle, so that when two gears are in mesh, there will be a clearance between the tops of the teeth of one wheel and the roots of those of the other wheel, equal to one-seventh of the height of the teeth.

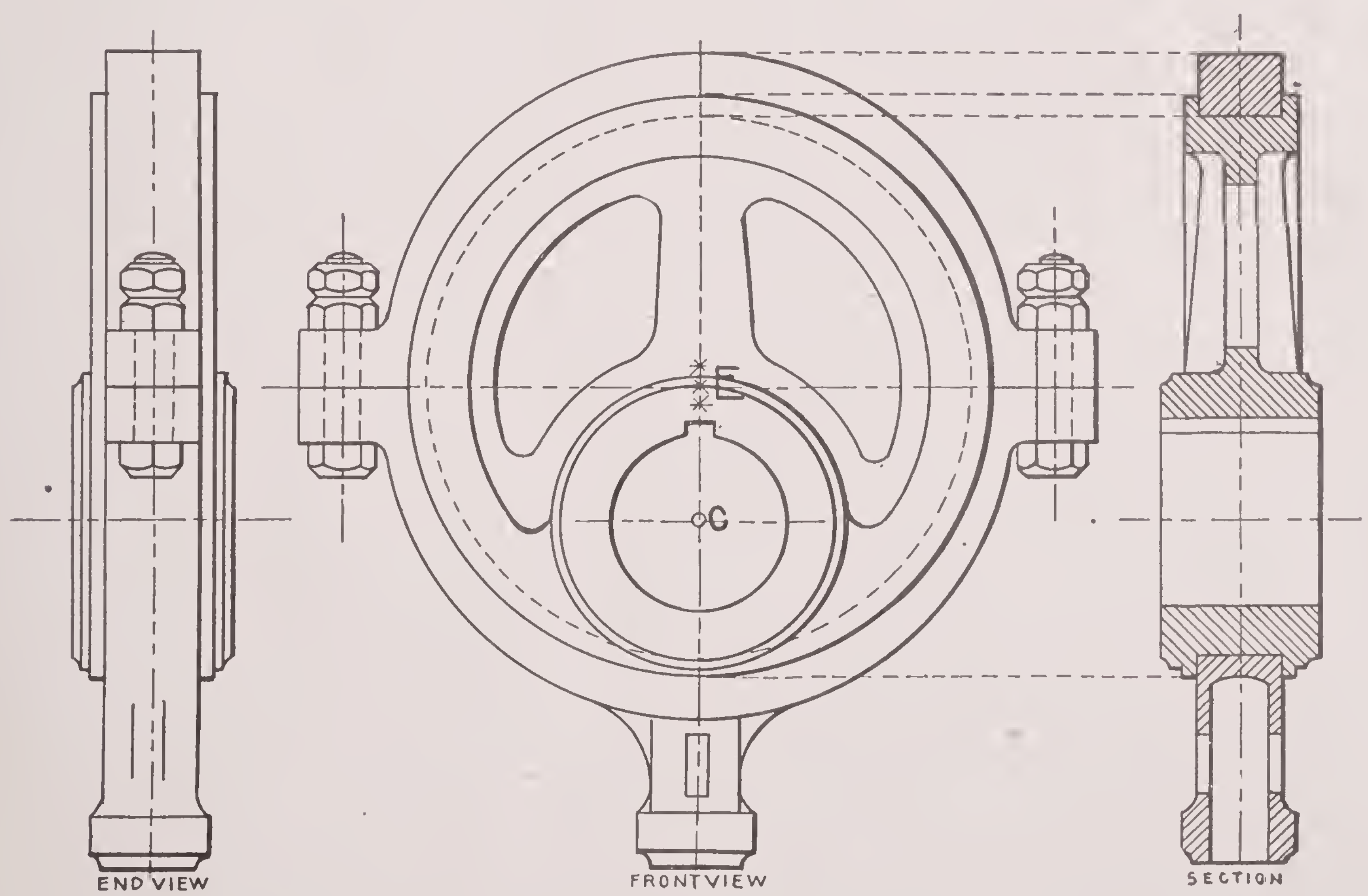



Fig. 103

The center lines of the six arms of this gear are easily found with the T-square and the 60-degree triangle, and after the front elevation has been completed, the side elevation and section are easily drawn, by drawing center lines and projecting most of the necessary measurements from the front elevation, as shown by the dotted lines.

PLATE VII represents front and side elevations of a four-jawed lathe-chuck. It is known as an « independent » chuck because each

jaw may be moved independently of the others. The slots between the jaws are T-shaped, as shown in the side elevation, so that bolt-heads may be slid into them for additional fastening means, when the object to be turned cannot be securely held by the jaws.

The concentric circles on the front of the chuck are traced by a sharp-pointed tool, when the chuck is made, as a guide for setting all the jaws at equal distances from the center, when a circular object, like a pulley, is to be held and turned or bored. These circles should not be shaded.

Figure 103 shows front and side elevations and central section of an eccentric and its strap, which is the means generally used for moving the valves of a steam-engine. An eccentric may be considered a crank whose pin is so large that it completely surrounds the crank shaft itself, C being the center of the shaft and E the center of the eccentric. Then the distance EC would be one-half the throw of the eccentric. The portion surrounding the eccentric, and fastened by bolts having double or « lock » nuts, is called the strap, the lower end having a socket in which is fastened the eccentric-rod, which drives the engine valve.

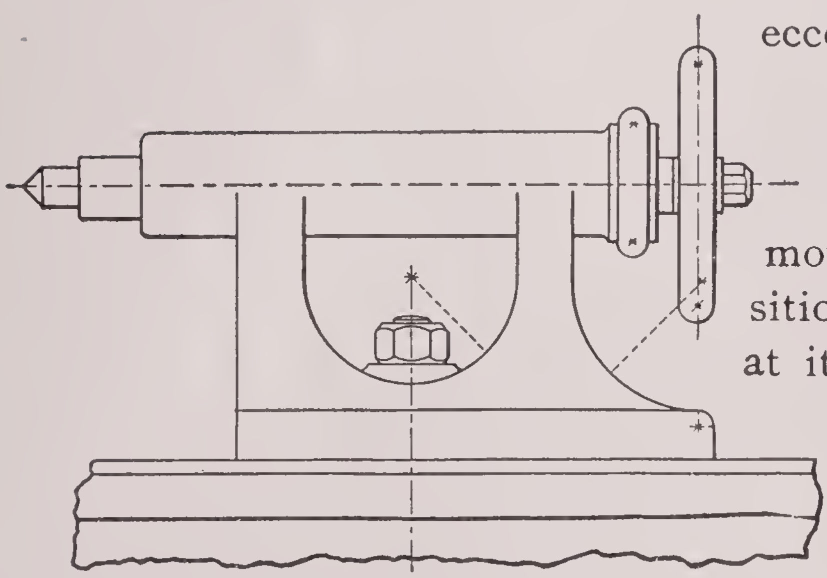


Fig. 104

Figure 104 shows a side elevation of the foot-stock of a lathe, and a portion of the « ways » or bed of the lathe on which it moves. The foot-stock is fastened in any position on the bed by means of the nut shown at its base. The pointed « center » at the left supports one end of the work being turned, and this center is adjusted by a screw, hidden in the upper, cylindrical part of the stock, and turned by the hand-wheel shown at the right.

If desired, the student may add to the finished appearance of the drawing by cylinder-shading the center, barrel, and hand-wheel of the foot-stock.

## INTERSECTIONS OF SOLIDS—PATTERNS

It sometimes happens that two parts of an object must be fitted together at an angle, or the end of one placed in the side of the other, and it becomes necessary to draw the curve which represents the joint. This curve may be very irregular in appearance, but it can always be found by finding a number of points along it and then tracing the curve through these points.

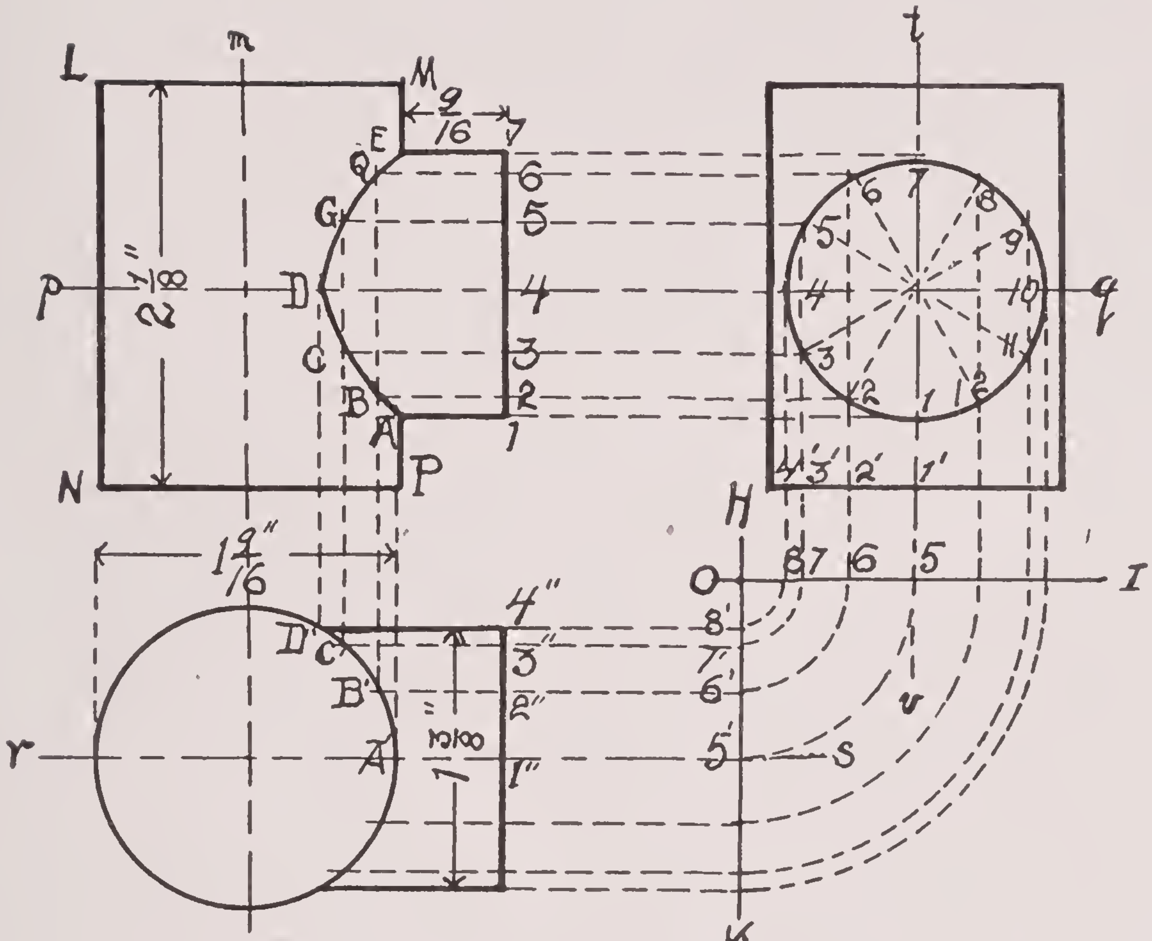


*Fig I*

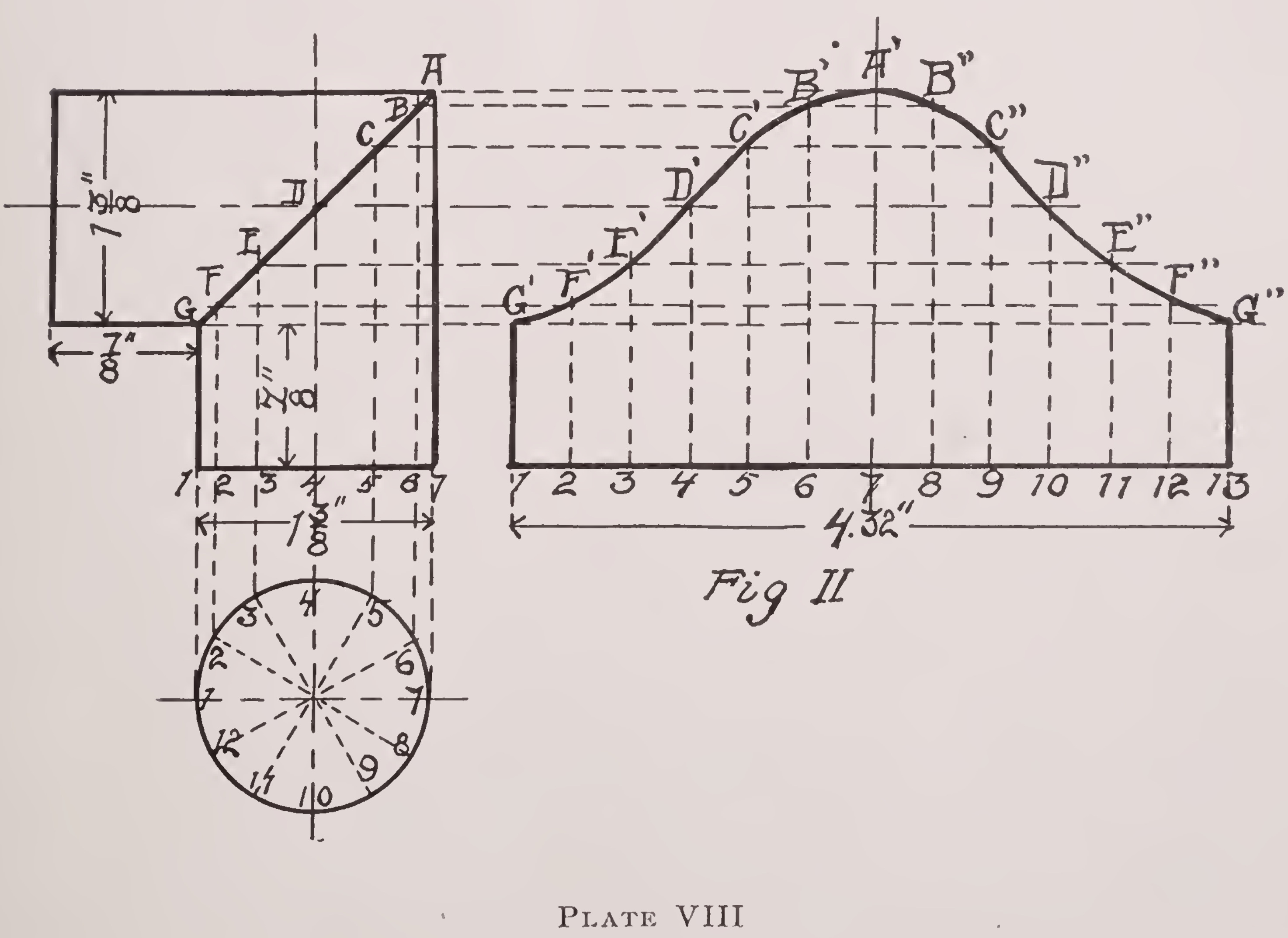


*Fig II*

Let us take as an easy example, the curve of intersection of two cylinders of unequal size, one joined to the other at right angles, as in the case of a tee for gas and water-pipes. Drawing first the two elevations (excepting the curve of intersection), as in the first figure of the plate, we divide the circle representing the end view of the smaller pipe into any number of equal parts — say twelve. If we project these points of division horizontally across to the other elevation, we see that we shall have one set of lines in the intersection curve in which the required points must lie.

Now drawing the plan, as will be seen in Plate VIII, Page 4021, we project the points 1, 2, etc., downward upon a line OI, parallel to the base-line of the side elevation. Through O, which may be any convenient point at one side of the elevation above, we draw a second line, OK, at right angles to OI and parallel to the outline of the plan. Next draw O8′, O7′, etc., equal to O8, O7, etc., which can be most easily done by taking O as a center and striking arcs around the quadrant. From 8′, 7′, etc., project horizontally to the points D′, C′, etc., and then project these points successively upward till they meet the horizontal projections from the corresponding points in the side elevation.

Let us now trace the projection of one particular point, as 2 in the side elevation. We know that in the front elevation it must be at exactly the same height, or somewhere along the line 2B. In the plan, we know it must appear directly below its position in the side elevation, and if the plan were drawn below this elevation it would appear as at 2″, the same distance from the center line *vs* that it is from *tv*. Now swinging the plan view beneath the *front* elevation, as indicated by the dotted arcs, we see that 2 (or 2″) is distant from the center line *mn* of the larger pipe, as at B′, and projecting upward from B′ along an "element" of the larger pipe until we intersect the horizontal line 2B, we find B to be one of the points in the curve of intersection. We may reason in the same way in finding the points C, D, G, etc., and when we have located them, in turn, we can trace the entire curve of intersection, ABCDGQE, through the points thus found.

If the two cylinders be of the same size, as in the second figure, the problem is much simpler, as the intersection curve then becomes a straight line, in side elevation.

Let us suppose now that our two cylinders are the two parts of a square stovepipe elbow, and let us try to draw a pattern of the piece of sheet iron necessary to make each half of the elbow. As before, draw a portion of the circular plan below and divide the circle into twelve parts. Suppose that the seam of the pipe is on the

line $G1$ of the elevation. We know then that the length of the required piece of sheet iron must be equal to the circumference of the pipe, and that its width at *each* end will be equal to the line $G1$. We then draw a horizontal line at the right of the line 1-7 of the elevation, at the same height, and step off upon it the twelve divisions of the circular plan. At each end we draw vertical lines upward until they meet the line $G'G''$ projected horizontally from G. In the same manner, we project upward from the intermediate points 2, 3, 4, etc., on the straight line, and also from the points 1, 2, etc., of the circular plan, till the dotted lines from the latter meet the diagonal line GA of the elevation. From F, E, D, etc., we project horizontally until the lines intersect the vertical lines from 2, 3, 4, etc., of the "developed" circumference. Then the points $G'$, $F'$, $E'$, $D'$, $C'$, $B'$, $A'$, $B''$, $C''$, $D''$, $E''$, $F''$, $G''$ outline the curve of the upper end of the pattern. The pattern of the other half of the elbow will, of course, be exactly similar.

## SIMPLE MACHINERY

THE following figures show some examples of simple machine drawings: —

Plate IX, Page 4024, is a side elevation of a drilling-machine having a ribbed cast-iron frame, and a pair of bevel gears for driving the drill-spindle. Lay off distances from dotted center lines, which should be drawn first. Notice that all lines of the tooth edges of the pair of gears may be drawn from a common point, O.

Plate X, Page 4025, shows side and front elevations of a combined punching and shearing-machine. The side elevation shows the main driving-shaft, with fast and loose pulleys, fly-wheel with a heavy rim for giving the machine steady motion, and on this, and the upper driven shaft as well, what is called a shrouded pinion; that is, a small gear-wheel having a web at one side to strengthen the teeth when the gear is liable to receive shocks, as in such machines as that here shown. The front elevation shows the punch and shear located at opposite sides, and the manner in which the main frame is reinforced to bear the heavy strain of severing metal.

Figure 105, Page 4026, shows side and elevations of an "engine" lathe, a large lathe in which the cutting tool is held and guided entirely by the machine itself. The upper half of the headstock is shown in section, and the dotted cone below it represents a series of hidden gears by which the tool may be fed more or less rapidly.

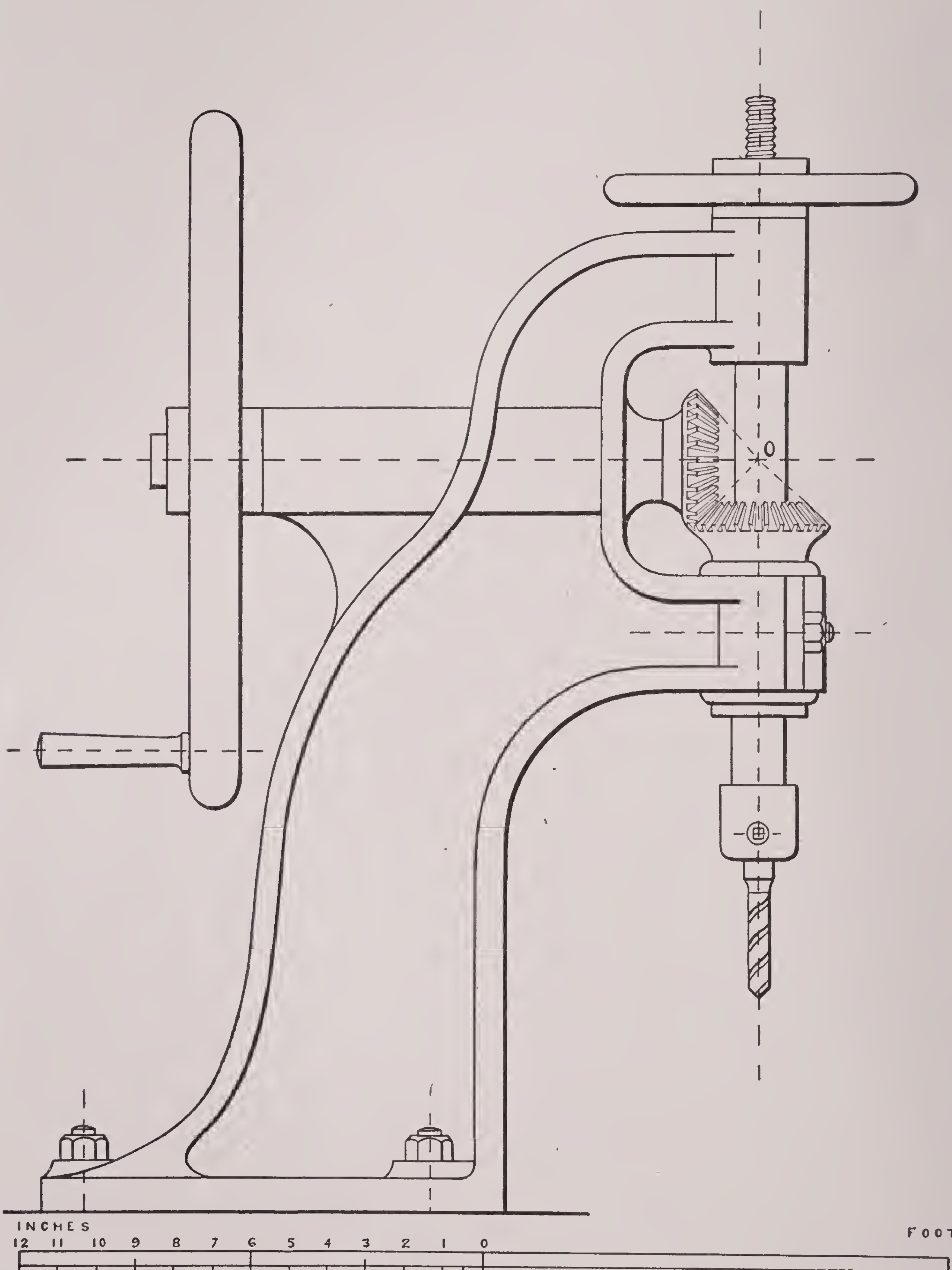



Plate IX

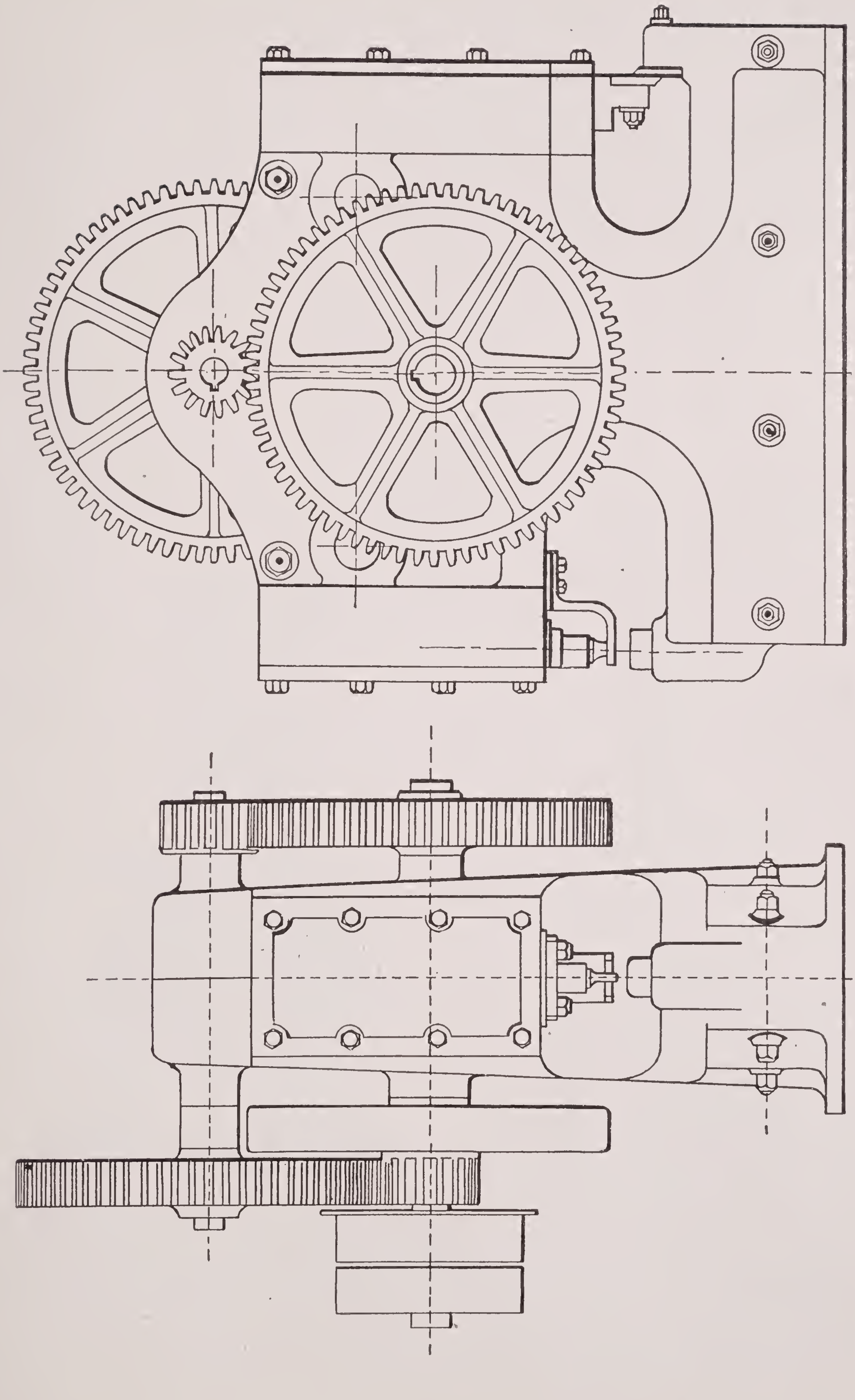


Plate X

One set of legs is enlarged into a hollow pedestal with a door and inner shelves for holding tools used about the lathe.

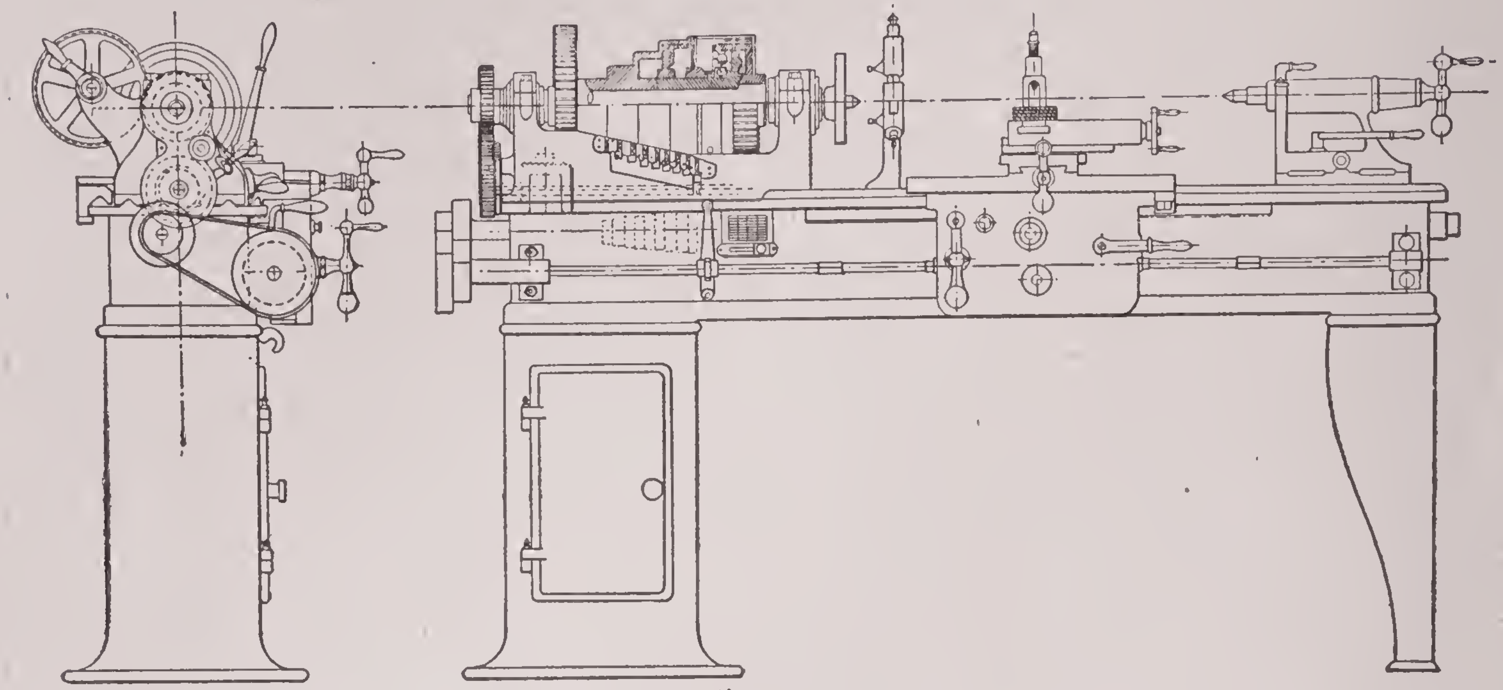


Fig. 105

Figure 106, below, represents a vertical section of a "key-seating" machine, having an upright pedestal and table for supporting pul-

Fig. 106

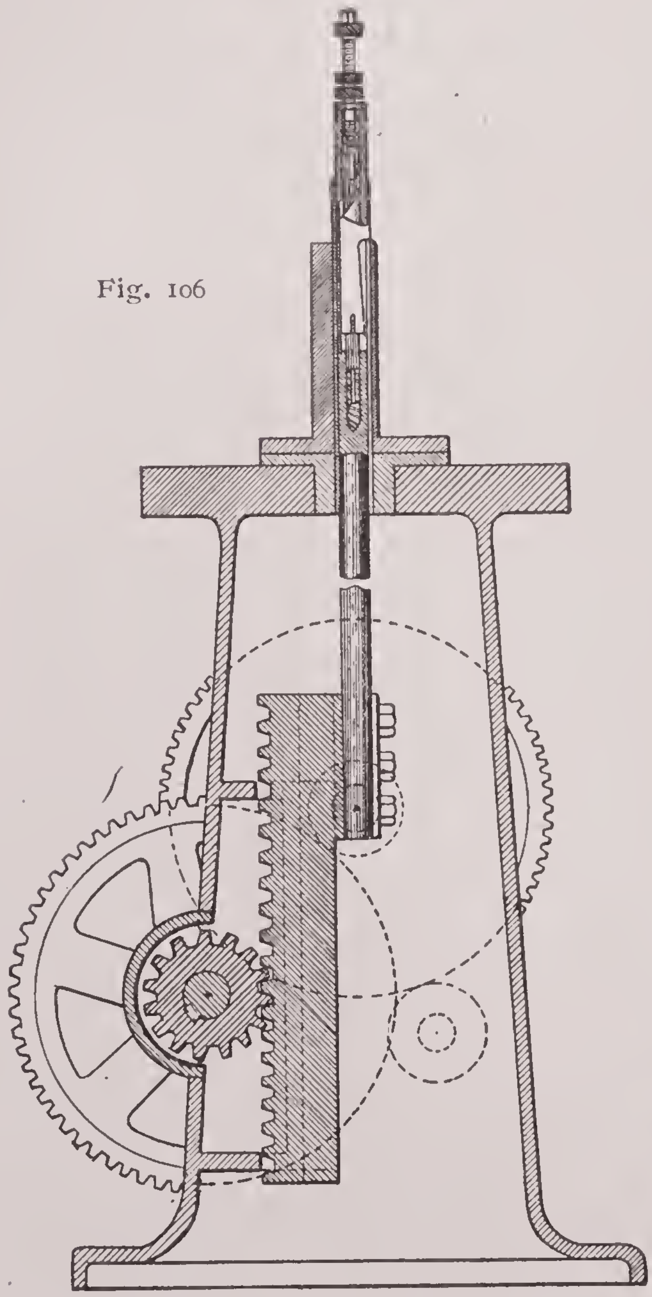
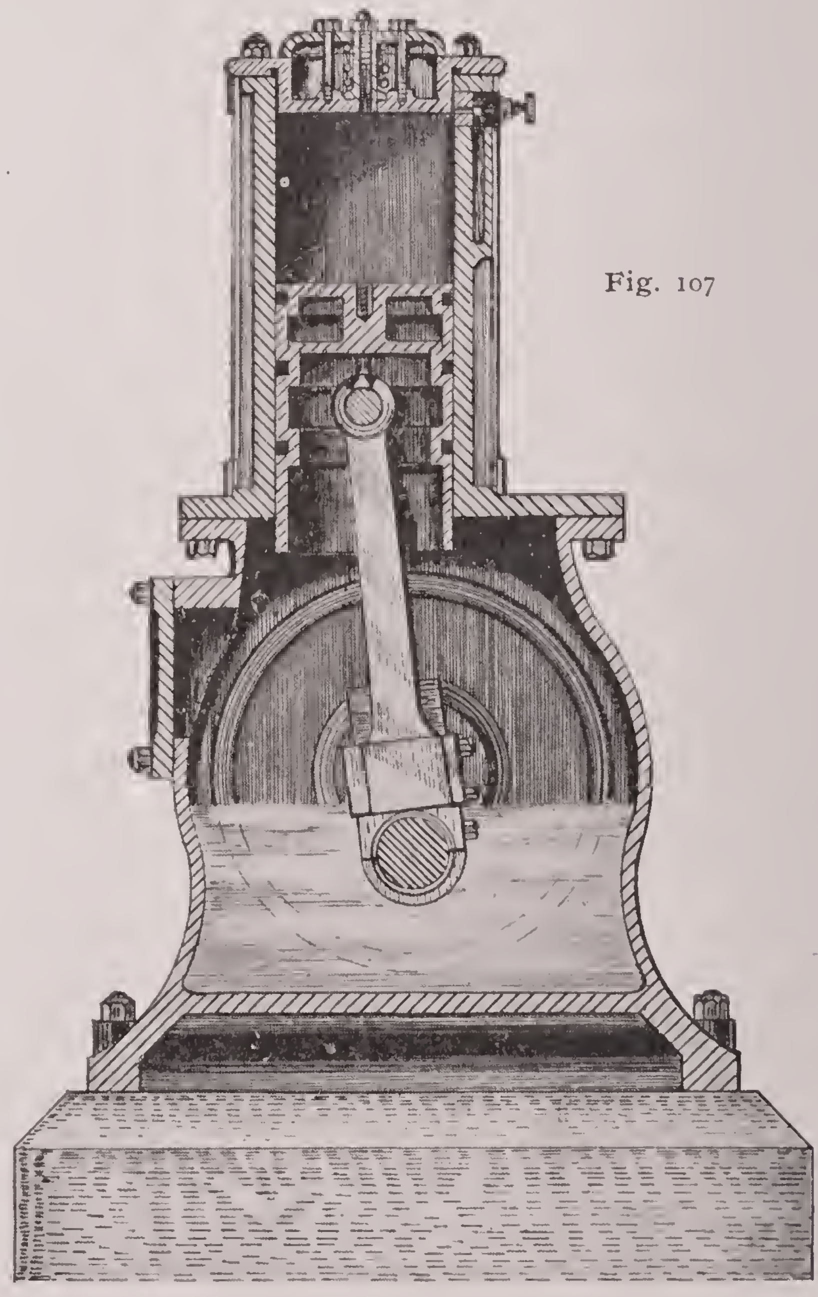


Fig. 107



leys, gears, etc., whose hubs are to have key-ways cut in them. The vertical shaft carries at its upper end a cutting tool which is moved

up and down by the "rack," or toothed bar, and the gear-wheels shown. The machine, of course, has proper means to reverse the motion of the gears.

Figure 107 shows a vertical section of a single-acting trunk-engine. The piston receives steam on one side only and is made very long to prevent steam from leaking past it. There is no piston-rod, the connecting-rod being fastened directly to the piston at one end and to the crank at the other. The crank is in a closed chamber filled with oil and water, into which it dips at every revolution.

This figure gives excellent practice in surface-shading, for the purpose of making the drawing easy to read by those unfamiliar with mechanical drawings.

## PERSPECTIVE

Perspective drawing is the art of representing on a plane, objects as they actually appear to the eye from a given point. In perspective, several planes, lines, and points, must be considered and their names and uses carefully memorized.

In the figure (108), ABIK, a vertical, transparent plane directly before the observer, is called the *picture-plane;* the plane EFGH, a horizontal plane upon which the observer is supposed to stand, is called the *ground-plane*, and the line AB, where the ground-plane and picture-plane meet, is called the *ground-line.*

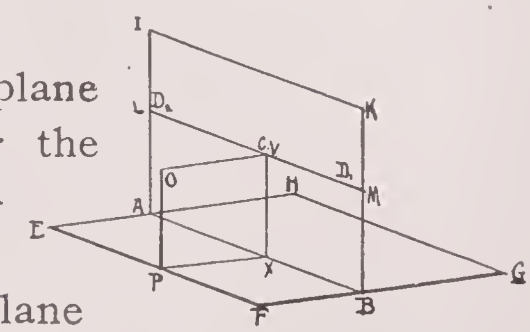



Fig. 108

The point P in front of the picture-plane where the observer is supposed to stand, is called the *station point*, and the point O at the height of the eye above the station point is called the *view point* or *point of sight.* The point CV, on the picture-plane directly opposite the point of sight, is called the *center of vision*, and is the foot of a perpendicular line projected from the eye upon the picture-plane. The line LM, parallel to the ground-line and at the height of the eye above the ground-plane, is called the *horizontal line* or *horizon.* The points D1 D2 on the horizon, as far from CV on either side as O is distant from the picture-plane, are called *distance points. Vanishing points* are points where parallel lines of an object which are *not* also parallel to the picture-plane *seem* to meet and disappear from sight.

The point of sight should be carefully chosen, and should vary for objects which are greatly different in size, but should, of course, never be changed in any one drawing. It should always be far enough from the picture-plane to enable the whole object to be plainly seen, remembering that the *visual angle*, or angle included be-

tween two rays drawn from the extreme sides of the object to the eye, should never be much more than 60 degrees, for clear sight. A line vanishes when its near end is at the eye and the far end cannot be seen. A line, then, vanishes to a point. In like manner, a plane vanishes to a line.

We should remember, however, that lines parallel to the picture-plane do not vanish but *appear* parallel in the picture; neither do planes parallel to the picture-plane vanish; but lines perpendicular to the picture-plane vanish at the center of vision.

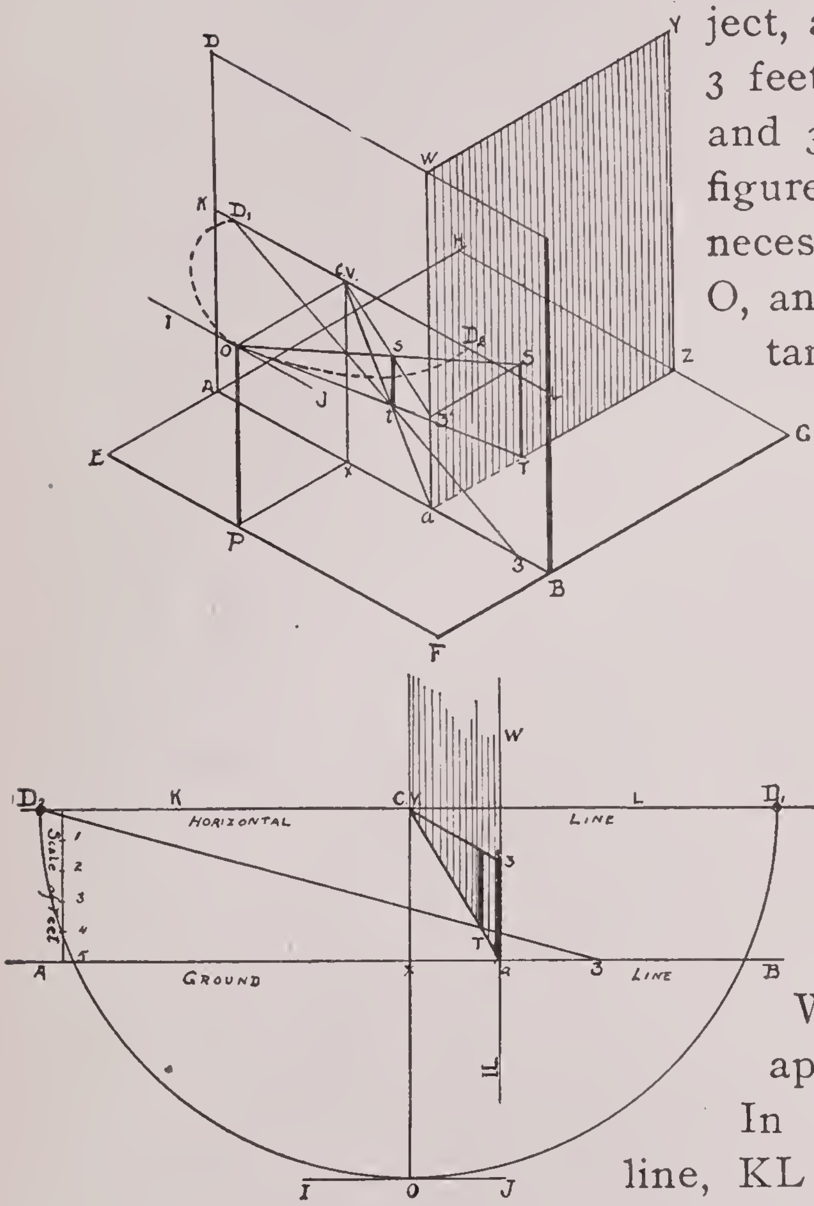


Fig. 109

Let us now attempt to represent in perspective the simplest object, a line which we will assume to be vertical, 3 feet long, 3 feet to the right of the observer, and 3 feet behind the picture-plane. The upper figure shows this perspective problem and the necessary planes in space, the observer's eye at O, and ours as those of bystanders at some distance to the right. (Fig. 109.)

The line we wish to represent is ST, in a shaded plane *a*WYZ, behind and perpendicular to the picture-plane, and the distances X*a*, *a*3′, and *a*T we have assumed to be each 3 feet. If we but draw the lines SO and TO, the points *s* and *t* where they pierce the picture-plane will mark the ends of the *perspective* of ST.

In choosing our point of sight, let us take it 12 feet in front of the picture-plane and 5 feet above the ground-plane. We will now lay out the sheet as it actually appears, taking a scale of $\frac{1}{4}''$ to the foot.

In the lower figure, AB is again the ground-line, KL the horizon 5 feet above it, O the point of sight, and $D_1$ $D_2$ the distance points. Lay off X*a* equal to 3 feet, and from *a* lay off *a*3′ also equal to 3 feet. Join *a* and 3′ with CV and we know that since *a*3′ represents a line 3 feet long *against* the picture-plane, our line ST must lie somewhere in the shaded plane and between the lines *a*CV and 3′CV, which is the limit of vision. To find the foot of the line, lay off *a*3 on the ground-line to the right of *a* and join 3 with $D_2$. Where this line intersects *a*CV will be the end T of the line ST, and by drawing the line upward from this point till it intersects 3′CV, we have the perspective of ST in the position assumed.

Using the same scale and distances for the point of sight for this and the succeeding figures, let us now represent in perspective, three

horizontal lines, each 6 feet long and lying 4 feet apart, all lying on the ground-plane and the nearest lying against the picture-plane (Fig. 110.) It is plain to see that the first line will appear in its true length, like an ordinary projection, since it is itself a trace on the picture-plane along the ground-line, being also in the ground-plane. We have only, then, to lay off 3 feet on each side of X, as at *a* and *b* and draw *ab* for our first line. Join *a* and *b* with CV.

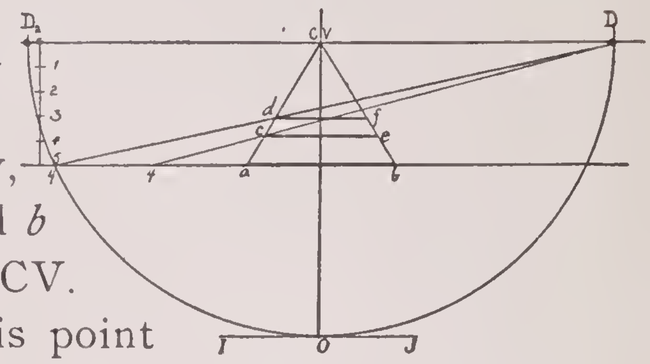


Fig. 110

From *a*, lay off 4 feet toward the left and join this point 4 with D1. Where this line intersects *a*CV, is one extremity of the second parallel line *ce*. We may find the other by laying off 4 feet from *b* toward the right, and joining the point so found with D2; but this is not necessary, since from *c* we may draw *ce* parallel to *ab* till it intersects *b*CV.

For the third line, lay off 4 feet to the left of 4 (or 8 feet to the left of *a*) and join this last point to D1, thus locating *d* and the line *df* as *ce* was located.

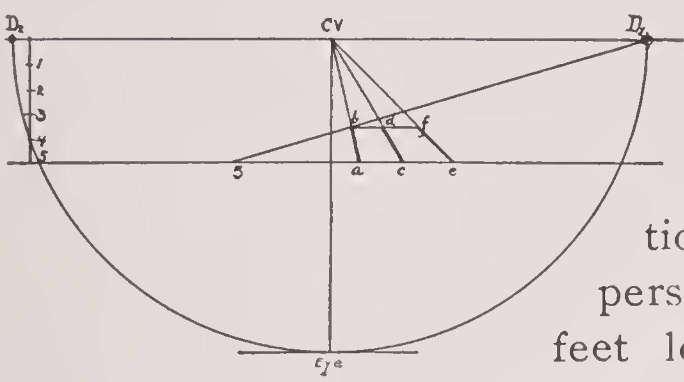


Fig. 111

Without changing scale, or location of the eye, let us represent in perspective three parallel lines, each 5 feet long and 2 feet apart, lying in the ground-plane perpendicular to the picture-plane, their nearer ends in the picture-plane and the nearest of the lines 1 foot to the right of the observer. (Fig. 111.)

From X, lay off X*a* equal to 1 foot, *ac* and *ce* each equal to 2 feet. Join *a*, *c*, and *e* with CV. We have now only to locate the farther extremity of the lines which is done by laying off X5 equal to 5 feet and drawing 5D1. From *b*, the intersection of 5D1 with *a*CV, we draw *bdf* parallel to the ground-line, and *ab*, *cd*, and *ef*, are the required perspectives.

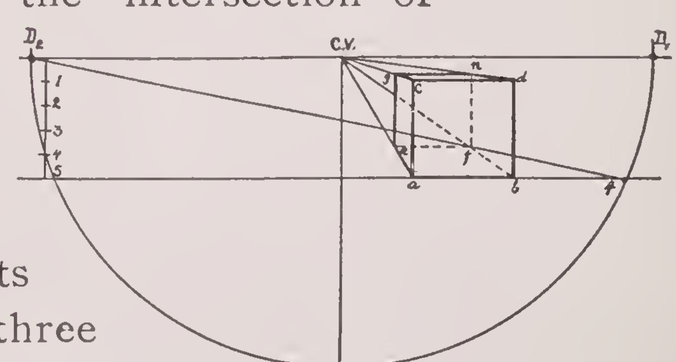


Fig. 112

To draw the perspective of a cube, 4 feet on each edge, (Fig. 112) on the ground-plane, with its front face in the picture-plane, the nearer edge three feet to the right of the observer. Lay off *xa* to the right equal to 3 feet, and from *a* draw the square *abdc* 4 feet square, representing that face of the cube lying in the picture-plane. Join these four points with CV. Lay off *b*4 equal to 4 feet and toward the right. Join 4 with D2, thus locating *f*. Draw *fe* dotted and parallel to *ab*. Draw *fh* and *eg*, vertical till they intersect *d*C.V. and *c*CV, respectively. Join *g* and *h* and the perspective is completed.

To draw the perspective of a circle 5 feet in diameter, lying in the ground-plane, its nearer edge touching the picture-plane. First inclose the circle in a square, drawing diameters at right angles and diagonals to the square, as shown in the plan below and at the right, thus locating a number of points, say eight, which correspond in both square and circle. Draw the square in perspective according to the principles already explained, and having found the location of the eight points in the perspective of the square, trace through them the perspective of the circle. This perspective will be found to be an ellipse, as was explained in the construction of that figure among the geometrical problems. (Fig. 113.)

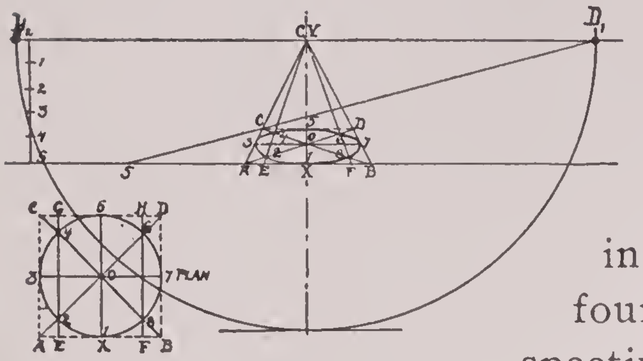


Fig. 113

As was explained in our lessons on working drawings, a perspective view is of no value in constructing an object except to give at a glance its general appearance as does a photograph; yet it is much used by architects in giving an idea of completed buildings, such as could not be gained by elevations alone. It will also be plain that every artist with brush or pencil almost unconsciously applies the rules of perspective in making sketches and canvases which delight the eye by "holding the mirror up to nature."

Thus closely, then, does our exact science of mechanical drawing approach that of the artist whose work is completed when he finishes the picture which delights the eye. His picture is the end of his work; ours is only means to an end — the construction of machines, edifices, and other structures, which may not only please the eye, but render the work of mankind less laborious and its leisure hours more comfortable.

# WOMEN'S PROFESSIONS, OCCUPATIONS AND BUSINESS COUNSELLOR

# WOMEN AS PHYSICIANS

*By ANITA NEWCOMB McGEE, M.D.*
*Lately Acting Surgeon, U. S. Army, in charge Army Nurse Corps*

The woman who takes up the practice of medicine should be equipped not merely with good health and intelligence, but also with an education above the average, and with means of supporting herself for a number of years. By reason of these conditions, and owing also to the peculiar character of the work required, it is a mistake for any woman to attempt to enter this profession unless she has a genuine liking for it; or to remain in it for one moment after it has ceased to interest her.

It should not be forgotten in this connection that in the broad field of general medicine and surgery, women were, in former times, almost unknown. The pioneer in America was Elizabeth Blackwell, who was born in England in 1821, became a school teacher in this country, and, after several rebuffs, was finally permitted to study medicine at Geneva, New York. After clinical work in Paris, and London, she established herself in New York City in 1851, and later started a dispensary and hospital for women, with which a medical college for women was afterward connected. Dr. Blackwell, however, returned to England, leaving in America her sister, Emily Blackwell, who graduated from the Western Reserve University Medical Department, at Cleveland, Ohio, in 1854, and who still lives in New York. The extraordinary difficulties which were met, and overcome, by these and other leaders in their profession, make them worthy the eternal gratitude of the sex.

In order to keep pace with the advance of medical science, the standards of medical training, and consequently of admission to medical colleges, have been rapidly growing higher during the entire past century. At the present time, medical colleges of the highest grade require a college degree, or its equivalent, as a prerequisite for admission. Thorough training in the natural sciences, especially in chemistry, biology, and physics, is of untold advantage to the physician, and, therefore, a student who is able to take a college course with special reference to these branches, should not fail to do so. A knowledge of French, German, and elementary Latin, is also important. When a candidate for admission to a medical college is not a graduate of some

recognized college, or normal school, entrance examinations in English, Latin, arithmetic, physics, and sometimes other branches, are required.

The course of instruction in all colleges of high standing now covers four years, not including summer vacations, which are four or five months in duration. In addition to lectures, recitations, and demonstrations, the medical student is required to spend many hours daily in laboratory work, so that she shall acquire a practical knowledge of chemistry, physiology, histology, pathology, bacteriology, and pharmacology. Of course, work in the dissecting-room is also required at the outset, and later, attendance on a large number of clinics, including medical, and surgical, work, in both hospital and dispensary. At the end of each year, written, and oral, examinations are held and when all are passed, the student receives her well-earned degree.

Twenty-one is the minimum age required for graduation, but it is far the wiser plan for a student to take ample time for preliminary work, and, incidentally, to acquire a greater maturity in her own development before beginning medicine. It now commonly happens that men enter college at eighteen, enter medical college at twenty-two, and after that, spend two years in hospital work, as a part of their training, so that they are twenty-eight years of age before they begin private practice. As two years not infrequently pass before a physician's income equals his expenses, it will be seen that under the most favorable circumstances of training, a person who enters this field cannot depend upon his profession for support until he reaches the age of about thirty years. Of course, some who entered a medical college with low standards,— one whose course covered but three years,— and who went directly from that to private practice, under exceptionally favorable auspices, have been able to support themselves from the age of twenty-two; but, on the other hand, the period of dependence may be indefinitely prolonged by delay in beginning the study, and by prolonging the period of post-graduate work in the hospitals. Women sometimes study nursing preliminary to undertaking a medical course; the knowledge thus gained is of great advantage to them, although training schools for nurses prefer, as a rule, not to accept applicants who enter with the intention of afterward becoming physicians. Some women have earned money during vacations, by nursing, and in other ways; this has, of course, helped them materially.

Almost all the homeopathic, and all the eclectic, medical schools, of the United States are coeducational, as are also a majority of the regular medical schools. In the years 1898–99 the statistics of the Bureau of Education report six hundred and eighty women as study-

ing in regular coeducational schools; three hundred and eighty-three in regular schools for women only; forty-eight in eclectic, and three hundred and fifteen in homeopathic schools. The choice between a one-sex college and a coeducational college is one which must be made in accordance with the inclination of the individual student. Since, however, the post-graduate education of women as obtained in their practical medical work must be coeducational — inasmuch as they must work side by side, and in competition, with men — it would seem that coeducational schools should, other things being equal, be preferred.

One of the leading medical colleges for women in this country is established at Philadelphia. This institution was founded in 1850, and in 1898–99 it had ten professors, twenty-one other instructors, and one hundred and forty-eight students; of the latter, twenty had previously received A.B. or S.B. degrees. The Woman's Hospital attached to this institution is well equipped and managed, and the college ranks very high. Another college for women only is that of Chicago, established in 1870 and having twenty-five professors, twenty assistants, and seventy-nine students.

It should be borne in mind that a medical college is a very expensive institution; some indication of the value of the instruction received may be obtained, in a general way, by inquiry as to the expense of the course. Of course this rule is valueless in state, or other specially endowed, institutions. For example, the fees for the four years' course in a Western medical college are only $300. This college suffers, however, under the disadvantage of being in a small town, so that the clinical material cannot be as large as that in a great city. A Southern college offers a four years' course for the remarkably low fee of $90, and had in 1898–99 one hundred and forty-one male and seven female students.

There is an important difference in various institutions regarding the opportunities offered to the graduates for hospital appointments or the position of resident physician. Information on this point can be obtained by securing circulars from different colleges. It is the poorest sort of economy for a woman of first-class intelligence to enter any but a first-class school, for, although she can overcome much by thorough study of books and patients, she will find it impossible to supply the lack of adequate laboratory experience, and of training in the best clinical methods.

On completing their training, a few women enter the missionary field, and a few others are able to secure permanent appointments in asylums for the insane, in colleges or schools for girls, and in other institutions; but the great majority seek to establish themselves in private practice. If one is free to select a location, and is both will-

ing and able to act the part of a pioneer, the greatest promise is held out in parts of the country where there are comparatively few woman physicians. To succeed in these localities, however, a woman must be possessed, above all things, of tact, of "grit," and of the essential *savoir-faire* befitting the community which she selects, for on these things will depend the continuance or the abatement of the coldness which she must anticipate at the outset. Women of less venturesome disposition will prefer to settle in the large cities, where a woman doctor is no longer a novelty, and where opposition from physicians of the other sex has been overcome or is discreetly concealed. Country practice, with its exposure to weather, and the remoteness from fellow-workers, has seldom been undertaken. Woman physicians are probably more prominent in Philadelphia than in any other city, a fact which may be attributed largely to the existence of the excellent woman's college there.

A most important factor in selecting a location in which to establish oneself as a physician, is the medical law of the state. In some, a diploma from a recognized medical college is sufficient for registration, while in others, an examination must be passed. Other things being equal, a state with high medical standards, and one where the proportion of physicians to the population is not excessive, should be chosen.

The income to be derived from the practice of medicine is something which cannot be estimated in advance. The very few at the top of the profession may earn from ten to twenty-five thousand dollars a year, but many, not so well equipped, can earn little above their expenses; many others abandon private practice entirely, to seek fields of labor for which they are better fitted.

The most advantageous conditions for entering private practice are generally found where the new physician has a father, or other colleague, in the profession, who recommends her, and who makes her, to a greater or less extent, his assistant. Of course, this is rarely possible, but it will be found that under any condition, the power of making friends is a necessary requisite to success. For practical purposes, the ability to convince other people that one can do a thing is perhaps quite as valuable as the actual capacity for doing it. To prove this, it is only necessary to point to the quacks, whose success depends not at all on their real knowledge, but on their ability to impress people with their assumed knowledge. In spite of this fact, any woman who wishes to hold an honorable position in her profession must realize that to maintain a permanent reputation she must never do less than her best. Medicine is a profession making such rapid strides that perpetual study is absolutely necessary to prevent

a practitioner from falling into ruts, and, in consequence, being left hopelessly behind in the competition with younger men or women. The medical journals, and the best of the new books, must of course be read, medical meetings be participated in, and visits to hospitals be undertaken as often as possible. The necessity for intercourse with fellow-workers is nowhere more urgently felt than in the practice of surgery. The great surgeons are improving their work every day, and any woman who attempts surgical work must make occasional visits to their operating-rooms a regular part of her program.

Another important matter is the location of the office, which should be carefully chosen in order to avoid unnecessary changes. It is usually best to establish a physician's office in a residence district, conveniently accessible to the class of patients that is desired; it is advisable to live in the house. Side streets are to be avoided, as the name at the office door constitutes practically the only form of advertising (if it may be called such) that is considered legitimate.

It seems hardly necessary at the present day to utter any warning against the adoption of methods savoring of quackery, but it may not be amiss to lay stress on the importance of every woman physician joining the organizations established to maintain the ethical standard of the profession. If in regular practice, she should, at the earliest day possible, become a member of the local association, and also of the American Medical Association. On the other hand, the scientific medical societies will prove valuable to her, by reason of the opportunity they afford for learning from others, and for making herself known to her fellow-practitioners.

In obtaining, and keeping, a foothold, personal appearance cannot be neglected, yet the dress, however rich it may become, should never be frivolous, or lead to a suspicion of lack of neatness in the care of the person. The same attention must be given to the appearance of the office, which should always look bright, tasteful, and tidy.

Most woman physicians will be called upon, more especially, to treat the diseases peculiar to their sex, but it is the part of wisdom to adopt the universal advice of the profession, and that is not to announce any specialty until after several years of general practice. A limitation to a practice which is almost, if not quite, carried on in an office during regular hours, has manifold advantages, but it is necessarily limited to the few, for the great majority of successful physicians' lives are full of calls on time, and strength, and of extraordinary demands at an hour when ordinary mortals are deep in their sleep-preparation for the labor of the coming day. The life of a physician is not an easy one, nor one which offers, without incessant effort, even a living income.

One of the factors which must never be forgotten in adopting this career, is the great responsibility which must be undertaken. Mistakes in every-day matters, or mistakes involving only money, may be forgotten, or atoned for, but the possibility of a mistake involving life and death carries with it a constant responsibility which is equaled in no other profession. For this reason, a woman physician must have a thorough confidence in herself — must be self-reliant, resourceful, and able mentally to stand alone.

## PROFESSIONAL NURSES

A long time ago, nursing was a calling carried on mainly by religious sisterhoods. Then came the days of "Sairy Gamp" and her kind, when nursing was a trade, undertaken for the money to be made from it. Now it has become a profession, which can be entered only after long years of training.

The first requisite for a successful nurse is perfect health, for without it she could not even pass the ordeal of the training school. The second essential requisite is an upright character that is both gentle and firm; a spirit of loving-kindness and patience, and an endless supply of tact. No nurse should permit a mistaken zeal to result in injury to her own constitution, yet if she feels no genuine devotion to the afflicted and helpless, her work will become a dreary routine of drudgery to herself, and a source of merely mechanical good to her patients.

Training schools usually require each applicant to have a good common school education, and some knowledge of household work. It is desirable that the age should be between twenty-one and thirty-five years. When a woman possessed of these requisites decides to enter the profession of nursing, her first task is the selection of a school. Practically, every hospital in the United States has such a school attached to it, and the future success of the nurse depends largely on a wise choice. The reports of the Bureau of Education will offer some assistance here, as will articles in the periodicals devoted to the interests of the profession.

Unless nursing is undertaken with some especial object in view, it is very desirable to select a general hospital containing over fifty beds, where experience in medical, surgical, gynecological, and obstetrical, cases is offered, and which is located in a city. New York is the headquarters of trained nursing, and has a large number of first-class schools. Speaking generally, it may be said that while there are good schools to be found everywhere, there are few west of Chicago or south of Washington that are as well organized and equipped as the best of those in the Eastern States. To study at a great city hospital is often an advantage, if one looks forward to institutional work; but preparation for private nursing is best obtained where the care of private rooms is a part of the course. It may also be noted that many of the leading schools have raised the time of residence from two to three years, and that they do not send pupils to nurse in private houses. A capable, ambitious woman will make a great mistake if she does not seek the best training obtainable.

Having decided upon a hospital, the applicant writes to its superintendent, or superintendent of nurses. The great majority of would-be nurses are rejected at once, but those who prove their fitness are appointed as vacancies occur. All hospitals require a probationary period, usually of one to three months, during which the general care of wards, dusting, sweeping, bed-making, and other simple duties are taught. If the probationer acquits herself well, she is accepted as a pupil-nurse, and now dons the uniform prescribed by the school. This is always a wash material, the apron and cap being white, and the dress generally blue, or blue and white.

The working-day usually consists of twelve hours, with two for personal rest or recreation, in the afternoon. Some of the best schools, however, have adopted the eight-hour system. Sometimes graduate nurses are employed as head nurses of wards, but this work is usually done by senior pupils, who instruct the juniors in the care of patients — the administration of medicines; record, and chart, keeping; and all the other details which have to be acquired. The training of eye and fingers in the detection of symptoms is learned by practice, while deftness in surgical dressing, and in the handling of instruments, comes with experience in the operating room and surgical wards.

In addition to the practical work and training, which is conducted under the direction of the superintendent of nurses, lectures are given by physicians, and recitations and examinations are held; the amount of such work as a rule being greater, the higher the standard of the school. As this study has to be carried on after many hours of physical labor, the test of training is often severe.

In acquiring any profession, the question of expense is generally of importance, but the trained nurse learns her profession while actually supporting herself thereby. In other words, hospitals give lodging, board, laundry, and medical care to their pupil-nurses, and usually pay them a fixed sum for the purchase of clothes and text-books. Five to ten dollars a month is the common amount. Asylums for the insane pay fifteen dollars and upward, while a few schools give a bonus on graduation, but nothing during the course. If nurses entered a hospital merely to learn their profession, and to leave as soon as that was accomplished, no such liberal inducements could be offered to them. But the hospital expects its nurses to work for it, and a pupil, is, for example, expected to make beds for years, although she may have learned in a day the proper way of doing it.

When the last examinations have been passed, and the time stipulated has been served, the pupil receives her diploma and enters the field of independent activity. The first necessity to that great majority who seek private practice is a connection with a good registry. This means that the name must be entered on a list at a central office, which has a telephone, and to which physicians and patients apply for nurses. Each nurse secures a lodging located where a message can promptly reach her, and then awaits her turn to be called. Some registries are maintained in connection with club houses for nurses, others are at hospitals, and sometimes they are privately kept by a few friends who have become well established in their profession.

The first duty of a nurse is as the doctor's assistant, carrying out his orders, and being strictly accountable to him for her own actions, and for her patient's welfare in his absence. Besides those duties calling her special knowledge into play, she must be prepared to perform many which are commonly considered menial, and to do them well, and willingly. These include cleaning the sick-room, cooking for the patient, and sometimes a little washing or sewing. But the nurse does not eat with the servants of the establishment; she is served alone, or takes her meals with the family. She is subject to call in the night, but if the case is so critical as to require unceasing attention, a second nurse ought, of course, to be employed.

The usual compensation of a graduate nurse in a city is twenty to twenty-five dollars a week. More than this is paid in New York to highly qualified women, and less is accepted by those who are lacking in training, or in the personal qualities so necessary to success. Besides the money, a nurse receives her board in the house of the patient, and should have time every day for taking outdoor exercise. The salary of a nurse is comparatively large, but her expenses are not light. Her room rent, and registry fees, must be met, and

her meals procured, while unemployed. She must dress well for the street, and also be amply supplied with white uniforms for duty wear.

The most important factor in estimating the real income of a nurse is the length of the time she is unemployed. It is impracticable here to name an average, as the strong and popular nurse may often go from one case to another, and have no time to rest unless she takes a summer vacation; while her less favored sister will spend half or two-thirds of her time in waiting. The working life of a private nurse, however, is short, as the nervous strain is so great as to wear her out, usually, in from ten to twenty years. Even if she remains well, she finds that in the overcrowded state of the profession, which is already felt in some cities, a preference is given to the younger woman, who is fresher from her training in the newest methods. As thousands of nurses, in ever increasing numbers, are graduated from our hospitals every year, this competition will before long become a serious matter.

Another factor which may come to the fore in the future, is the male nurse. The latter is being trained in a few exclusively male schools, and in some which accept both sexes, the number having reached approximately one man to every nine women, graduated annually. Most of the male nurses, however, have been trained in asylums for the insane, and they do not as a rule possess the refinement, or the reliability, of the woman nurse.

A variety of private work for which a demand is arising is "hourly nursing," which means that the nurse lives at home, and visits several patients each day, remaining long enough to attend to a surgical dressing, give some treatment, or to perform other services for those who do not require constant attention. In New York, ten dollars a week is a usual charge for an hour's visit a day. District nursing is similar to this, but only indigent cases are visited, and the nurse is employed by some charity organization. The district nurse is expected to care for all degrees of illness, and to teach some relative, or friend, of the patient how to care for him in her absence; she must also try to inculcate hygienic principles whenever possible. To many nurses, this district work, and that done in nurses' settlements, is most congenial and gratifying. Every nurse likes to see the good effects of her labors, and there is so much to be taught to the poor that, hard as the work is, she feels well repaid in seeing the improvement she has wrought.

Although the main body of nurses is engaged in private work, there is an important minority who are otherwise occupied. Some hospitals, asylums, and similar institutions, employ graduates as head nurses, matrons, etc., at salaries of twenty-five or thirty dollars a

month, with board, lodging, and laundry. Expert surgical nurses sometimes receive forty or fifty dollars. Although this remuneration appears very small compared with that of a private nurse, the absence of outside expenses, the certainty of employment without intermission, the fixed hours, and the absence of the occasional excessive strain, and responsibility, makes it easy to keep such positions filled.

There are, of course, a variety of minor openings of which a few nurses avail themselves, such as services in a doctor's office, entering the Indian service, maintaining a private hospital or sanitarium, supplying delicacies for the sick, etc., but most of these require some special ability, means, or influence.

Since April, 1898, the Army has opened a new field for graduate women nurses. In September, 1898, about thirteen hundred were serving in the Army, and the number in 1899, and 1900, was between two hundred and two hundred and fifty. Their pay is forty dollars a month, with board, lodging, and traveling expenses, ten dollars additional being allowed for service outside of the United States. Chief nurses, promoted to executive positions for ability shown in the service, receive salaries ranging as high as seventy-five dollars a month.

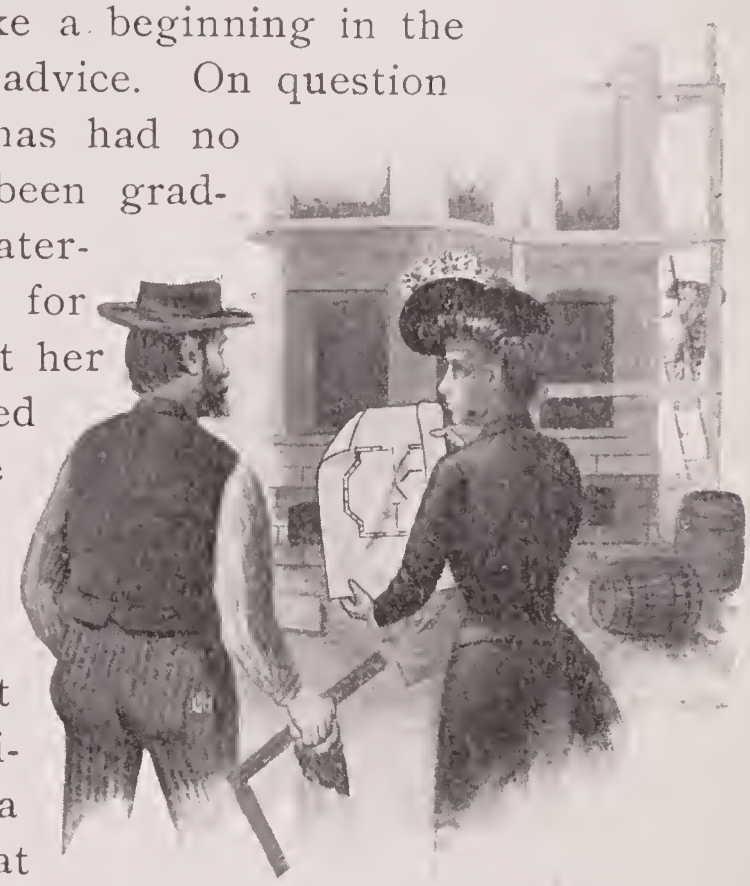
Outside of this Army work, the most responsible institutional position commonly held by nurses is that of superintendent of a training school. A few hospitals have nurses as superintendents of the whole institution, and some large ones employ assistant superintendents of nurses. To attain the grades in a hospital of repute, a woman must have a good general education, and have been graduated from a first-class training school, where she gave evidence of possessing executive ability. The head of a training school is responsible for all the nursing department, both the care of the patients, on the one hand, and the teaching of the pupils, on the other, but the details of her duties and responsibilities vary greatly in different institutions. She usually receives between fifty and one hundred and twenty-five dollars a month, with two rooms, board, and laundry, and is a person of great importance to the welfare of the hospital with which she is connected.

Such is the career of a nurse. It means hard work, repaid by the satisfaction of good deeds, well done.

# WOMEN AS ARCHITECTS

*By JOSEPHINE WRIGHT CHAPMAN*

Among all the branches of work into which women have entered, there is none that shows so small a percentage of really successful members as that of architecture. Almost every day some young man or woman who wishes to make a beginning in the architectural profession, comes to my office for advice. On questioning the young woman, I usually find that she has had no technical training in this branch; she has just been graduated from a high school, has perhaps studied water-color painting or drawing, and, having a taste for such work, has decided that architecture will suit her very well, until the time when she shall be called upon to leave the building of homes to preside over a home of her own. And just here, I feel sure, is one great cause of the failure of women in any business. Every woman, whether she admits it to herself or not, expects to enter, at one time or another, into matrimony, and the business or profession which she chooses serves as a bridge to connect the period of girlhood with that of wifehood. There is not the earnestness of purpose, the grim determination to succeed, that is felt by a man in the same position. It is his life-work, and matrimony only increases his energy.



In the case of the young man entering architecture, he has probably had the excellent training of the Massachusetts Institute of Technology, or some other technical school; sometimes he is a carpenter's son, who has worked for his father, has an ambition to advance in his studies, and who, not having the means for a technical education, hopes to enter an office and intends to study at one of the many good evening schools which the city provides.

When I question the girl as to her ideas, her answer may be: "Oh, no; I never could be an architect. I only thought I might be able to do drafting or to make the water-color pictures of the outside of the houses." I always discourage such girls, for architecture means far more than making pretty water-color sketches, and I advise them to take up interior decoration, stained-glass designing, or some similar art.

The lack of seriousness among these girls is shown in the case of a young woman who came to me not long since determined to study architecture. In the course of my conversation with her, it developed that she was soon to go abroad, and as music did not interest her, and it was the fad to study something while across the water, she had hit upon architecture as being the profession least studied by women, and therefore that which would cause the greatest sensation among her friends.

Although artistic ability is perhaps of more importance in architecture than is the knowledge of mechanics, nevertheless, it is very necessary to have the mechanical knowledge. One should also have an idea of the different materials employed in a building, their manufacture or their preparation for the building, their durability, and so on. Now a boy is naturally more inclined to mechanics than is a girl. Take a boy of twelve years and, by questioning, you will find he understands far more of mechanical devices and their workings than does the average grown woman. Boys are much more observant than girls in such matters, and I attribute this to the fact that the girl's mind is occupied with observing the fashions in clothes, the style of hair dressing, and such trivial femininities. The lower schools, in many cities, are in part at fault in this, for while they give to the boy mechanical drawing and carpentry work, the girl is taught to cook and sew. A boy is, by nature, physically stronger than a girl, and this gives him another advantage over his sister architect. Although no manual labor is required, yet a certain amount of physical endurance is necessary. It is very trying for a girl to lean over a drawing board and reach as a man does, especially if she wears the corsets and tight sleeves which fashion requires. An architect is also obliged to be out in all kinds of weather, to attend to the duties of superintending buildings, and he must keep appointments, rain or shine. This leads to the much discussed subject of the dress of the business woman. A woman architect may wear, in business hours, a comfortable tailor-made gown of the sensible storm length now so commonly worn. It may be as fashionable as one pleases, provided the tailor effect remains. There is no excuse for a girl being mannish in dress, any more than there is for her being masculine in her actions.

In meeting men in business, too, a girl is often put in a trying position. I know of no business or profession where one is brought in contact with so many different classes of men as is the case in architecture. Beginning with the client and going through the grades from contractor to laborer, almost every sort and condition of man is represented, and to deal with these different natures requires a great

deal of tact. A woman, in this, as in other business dealings, must learn to meet men on their own ground.

Another cause of failure of woman architects is the economical streak possessed by almost every woman. Women are prone to economize. Where a man would rent a good office and conduct his business in a businesslike atmosphere, a woman fancies it is just as well to do what she can at home and thus save office expenses. This is a great mistake. To save money, one must spend money.

In my own experience of the last four years, I have always carried out this principle. I have a large drafting-room, private office, and waiting-room; and I aim to have the most convenient arrangements for drafting and for filing away papers and plans. I also find that a telephone is most necessary. I employ a stenographer, and as many draftsmen as my work requires, for I feel confident that an architect, to be successful, cannot afford to spend her time in doing the work which a draftsman can do as well. She should have her time to devote to designing, superintendence, and other more important work. In my office, I employ girls, when I find that they are able to do the work, but I fully appreciate that a man in my place would hesitate to ask a girl to perform the many menial duties which he would require of a boy in the same position, and this is the reason why men object to employing women in their offices. I require the same services of a girl, not only because it is the best training for her, but because I cannot employ a girl unless she is willing to do the work of a boy in the same position.

I have stated many reasons why it is difficult for a woman to succeed in architecture, but, of course, as judicial people are inclined to remark, "there is much to be said on either side." In many ways the girl has the advantage. Whereas man is born with a mechanical instinct, woman is born with a housewifely one; and even if her tastes run in other channels, her ideas on the requirements of a house are far more practical than those of a man. Take, for example, a linen closet: how few men would stop to think of the width of a sheet when folded, or the length of a pillowcase. The arrangement of shelves and closets and the little conveniences of a house make a great difference to the housekeeper.

Women, too, are more patient than men in small matters. The little details of buildings, which bore a man, are interesting to a woman; and she is willing to spend more time, and to work more conscientiously, over such things than is he; as, for instance, in preparing plans and specifications for estimates. A woman will take the trouble carefully to designate, in these, the different materials to be used, so that at a glance the contractor can easily figure the cost of

the building, and, consequently, can give a lower figure, as he is not obliged to add an amount to cover uncertainties.

When one has finally surmounted the obstacles in the path leading to success, there is no profession which is so interesting or so varied in its aspects as this. Although I have passed through many trying situations, and have had many obstacles in my path, I have never for a moment regretted that I chose architecture as a profession. I should advise a young woman contemplating entering the profession to obtain, as a preparation, a good technical education, studying especially free-hand drawing, and at the same time visiting and observing the buildings which are going up about her. Her school education finished, let her enter the office of the best architect of whom she knows, and start on the same ground as a boy apprentice; receiving little pay at first, but exercising a keen observation and keeping her mind receptive to what goes on about her.

# WOMEN AS LAWYERS

According to the census of the United States for the year 1890, there was a total of 89,422 lawyers in this country, of which number but 208 were women. An average of not more than one member of each class in the law schools of this country is a woman; and not more than twenty-five are admitted to the bar of the courts of the country each year. Yet, notwithstanding these figures, women have made enviable progress in the profession whenever they have chosen it as a career. This is a most conclusive argument that there is plenty of room at the top of the ladder, in the study of law, for those who are ambitious. There are to-day thirteen women who have been admitted to practice at the bar of the Supreme Court of the United States, and every city has its quota of feminine legal lights.

The foundation for the practice of any profession is a sound education, and for the bar, the demand for this requisite is especially insistent. True, there are many eminent examples of men who have gone to the front with no collegiate training, but they are of a past generation, and the members of the bar to-day are men and women, who have secured their education in the colleges and universities of the country. After the ordinary college course, a special course is necessary in a school of law, and for this latter, at least three years are required, making a total of seven years at college. Presuming the aspirant to have been at school for twelve years, from the age of six, before entering college, a total of nineteen years at school are necessary before the student is capable of passing the examination for admittance to the bar, and she will be twenty-five years of age. This is considered youthful in the learned professions, for renown seldom comes before middle age.

Practice of the law is constant study; there are thousands of books upon the subject, and new ones are constantly being printed; and with a large share of these the lawyer must be fairly familiar, while of many of them he, or she, must have an intimate knowledge. Heretofore the woman practitioner has had to contend with the assumption of superiority by men, but this is rapidly giving way to the respect that she has forced from him by virtue of her abilities, and to-day she may rise in any court open to her, and present her argument of a case with every assurance that she will receive the same treatment that is accorded to her brothers in the law. A former assistant attorney-general of the state of Montana was a woman who

ran for the higher office against her husband, the latter winning the election, and appointing her to the office which she held with honor.

The difficulties in the way of the woman practitioner having been set forth, something of the pleasant side is timely. She will find that her clients will be largely women; a woman will talk to another in affairs of a personal nature more freely than she will to a man. Yet this limitation of her practice to her own sex will be by no means absolute, and she will have a goodly number of male clients. Many female members of the bar are frequently associated with men in cases in which the men do the work in court, and the women the office work. Criminal cases are not naturally a woman's selection, yet there are instances of women making first-class criminal lawyers, arguing their cases before a jury, and securing acquittal for their clients.

Probate work for women is coming to be their special field, and in some cities where there is a goodly proportion of women at the bar, almost half the wills are drawn by them. One young woman, recently graduated from a prominent law school, but not admitted to the bar, made three thousand dollars in her first year of practice of this branch, using her father's name, and his office, for her labors. She has since become a member of the bar, and her income is growing with each year.

There being so few women in the profession, and the sentiment in their favor growing with each year, it follows that there is no better field for the ambitious, educated woman, than the law. This is, however, always providing that she has a natural aptitude for study, for she will not make a success of it if this is not the case.

An eminent woman member of the bar of the Supreme Court of the United States holds that a woman's place is not in business unless she is forced there by necessity; that she should make the home, and that the bread-winning should be left entirely to the man; but she also says that if a woman is compelled to earn her own living, and is an educated woman, fitted for the profession, she can do no better than to study and practise law. To a studious woman it holds a charm not to be found in any other work.

Law is a science carefully adjusted to meet every requirement of justice in the category of human disagreement; it is based upon reason, and administered by logic; its principles to-day are the same as those existing in the time of Solomon, and it develops with the requirements of the times in which it exists.

If the woman who has a desire to follow the profession of law wishes, she may with wisdom study with a view to employing her knowledge in a law office as clerk and stenographer, but she will find that

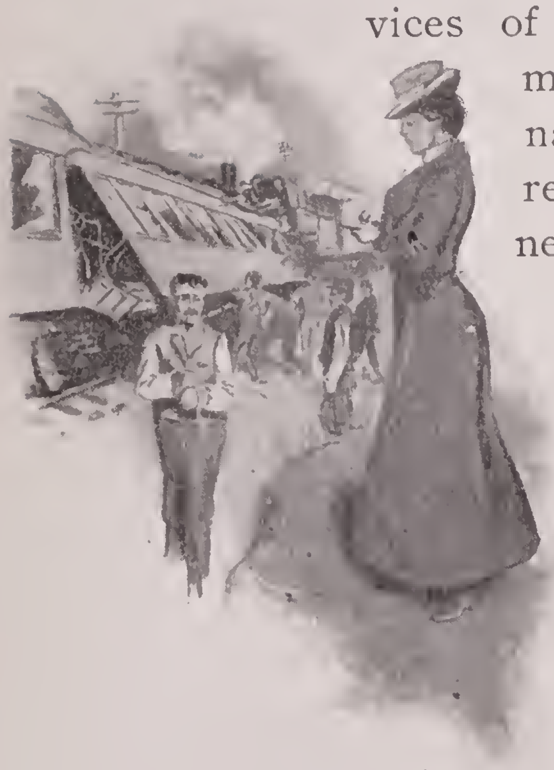
she will wish soon to branch out into a full-fledged lawyer on her own account, when she has mastered the minor technicalities of the science. Her woman friends will consult her on affairs of business, and of the heart, and she will find that the information she is giving freely can be turned to account as a producer of money. This will be her incentive, and she will not long be content to work for anyone but herself.

The expense of a legal education is not great. A hundred dollars a year will pay for the tuition at a good school and for the books required. This is not in excess of the charges at other schools, and the student passing the final examination may at once gain admittance to the bar and begin practice. If the woman has a man friend, or relative, who is a practitioner, she will find it to her advantage to take up business quarters in his office, for although she has the theoretical education, she will have to secure much of the practical before she will gain the confidence that is essential to success. The rest depends upon herself and her abilities.

# IS THE NEWSPAPER OFFICE THE PLACE FOR A GIRL?

*By EDWARD WILLIAM BOK*

It is, perhaps, natural that the first desire of a girl should be to "write for the papers" when, by a reversal of circumstances in her father's home, it is necessary for her to earn some money. It sounds easy; the work is "genteel," and the girl feels that either the collegiate or social opportunities she has enjoyed will make her services of some value to a newspaper. At least, it seems the means nearest at hand. The girl knows nothing of the nature of a newspaper office or of what newspaper work really means. Her knowledge is confined to seeing the newspaper as it has come into her father's home.



The parents, however, have heard diverse reports of the influences which exist in newspaper offices, and they do not feel altogether sure as to the wisdom of allowing their daughter to enter one, keenly though they feel the necessity of her help. And from this state of uncertainty have no doubt been born the scores of letters which each year come to my notice, all asking the same question: "Will you tell us something about the average newspaper office as a place for a young girl to work?" No doubt many parents to whom I replied have felt that my answers were very unsatisfactory. But, as a matter of fact, I have never believed that this was a question which could be satisfactorily decided from any single opinion. I felt that it was rather a question for the women already in the newspaper offices, who had seen service of from three to ten years each, and for the men who are editors of newspapers, and who are fathers, to decide. Their opinions would, at least, be born of practical experience and observation.

Accordingly, some time ago I addressed a personal letter to fifty of the leading newspaper women of this country, asking them to answer for me, frankly and without reserve, with the assurance that their names would not be used, the same question which hundreds of parents had put to us:—

"If you had a young daughter, desirous, or forced, to go into the outer world, would you, from your experience as a newspaper woman, approve of her working in a daily newspaper office? If not, why not? And under what, if any, circumstances or conditions would you sanction it?"

Forty-two of the fifty answered the questions. Of these, twenty were married women — the majority, mothers. All were perfectly frank and fearless in their answers. Of the forty-two, three answered in the affirmative. The others, thirty-nine, replied in the negative. Naturally, many will ask: What objections did they advance? A few are here given: —

One of the most prominent of all the writers said: —

"My objections to a newspaper career for a girl would be two: First, and this applies to a man as well as a woman — its lack of permanence. As a career, it is absolutely uncertain. Second, and this is paramount — its harmful effect upon a girl's health. I scarcely know a woman who has been engaged in newspaper work who has not broken down, at least temporarily. The work has, first, that difficult element of subjectiveness rather than objectiveness; and, second, it has great irregularity of living, with a nervous strain which is almost constant. In fact, I believe that the successful newspaper woman has to break down, for she succeeds only in proportion to her possession of that quick responsiveness and nervous energy that we all know is a part of the mental outfit of the successful newspaper man as well as woman."

Here is the ethical side, rather than the moral: —

"If she were a girl under twenty-five, unless her character was strong and formed, so that she was able to preserve the right proportion in her view of her daily life, a newspaper office would tend to dissipate many of her wholesome illusions. To a sensitive, carefully nurtured girl, the profession would entail many disagreeable duties. I think every high-minded girl is equal to protecting such high-mindedness, and that she elevates the profession more than it lowers her, but I think she does it at continual cost."

This comes from a mother of daughters, who has served twenty years in newspaper work: —

"It is not because I think that companionship with men in an office is dangerous to a young girl in a moral sense that I oppose such conditions, but because of the circumstances of carelessness in manner, thought, and action, which are almost inevitably the resultant behavior of the men in an office, and particularly in a newspaper office, toward their constant companions, be they men or women. To a young girl, this carelessness of manner is unwholesome, leading her to attribute to all men this lack of courtesy on the part of some."

A successful newspaper woman, herself married, says:—

"For a young girl, I consider a newspaper office the most appalling moral eye-opener imaginable. Naturally, where all subjects are published, they are to a great degree discussed, and a woman must hear things that no amount of chivalry from her masculine co-workers can prevent. That *bon camaraderie*, which a woman of the world understands and can cope with, is often the undoing of the young girl, who grows flippant and unwomanly in her desire to be regarded favorably by members of the staff."

Another element in the life is pointed out here:—

"It is the freedom which the work gives that is bad. With practically no definite hours, and a stipulation only that 'copy' shall be in in time for to-morrow's edition, there comes a dreadful sense of freedom which unconsciously deteriorates into all sorts of license of language and behavior, the combination that makes the world believe all newspaper women to be 'Bohemians.'"

One of the cleverest women in the newspaper field says:—

"No, no! a young girl gets too close to the Tree of Knowledge in our business. Not that I believe a girl should remain ignorant all of her life, but I want my daughter, if she must learn the world, to learn it in any other way than that forced upon her by coming in contact with those votaries of sin who make it most attractive, and, to all appearances, least lacking in wrong."

Two actual "assignments" are here given from the life of one of the best-known American newspaper women, but who has since left the profession:—

"Let me just lay my first two 'assignments' before mothers, and they will answer the question, I think, for me. They are actual, too. The very first day I went to work on a newspaper I was sent to interview a chorus girl. I found her living at the most expensive hotel in the city; surrounded by every evidence of luxury; she drove to the theater in her own brougham. Yet her salary was sixteen dollars a week. My salary depended upon the hard work I did, and averaged eleven dollars a week. Was that calculated to impress upon me the value of hard work? I was just as pretty as, perhaps a little prettier than, that chorus girl. The next day I interviewed a great statesman—a man known all over the world as brilliant, witty, and wonderfully attractive to women. This man was cynical. He treated me courteously enough, yet every woman will understand when I say that, as a mere girl, he gazed at me in such a way that the blushes came to my cheek and I felt that I was not quite as ignorant as I was before. Are such experiences—and I had scores like them—calculated to keep a girl sweet and modest?"

From a very pretty and capable college girl, who has been a successful reporter for several years, come these words: —

"A newspaper office certainly tends to make a woman too independent, too free, too broad. It establishes her on a footing with men that is not wholesome; it gives her opportunities for freedom that are not uplifting. She may not become unwomanly, but less womanly she does grow. Her life becomes without conventionality, and that is not wise for any girl. The life does not tend to make her delicate or entirely refined. It makes her overcome, every day, obstacles that tend to harden her; to lessen her illusions about gentleness and the personal self-respect needed."

A newspaper woman with years of wide experience says: —

"We hear a great deal about men and women becoming each other's natural companions in the outer world; that it is no longer mere sex-feeling which draws them together, but a common interest in the great social problems that each is trying to solve. I heard one woman say on the platform not long ago that men were 'throwing off the fetters of physical grossness, the tyrant love of rule and misrule,' and that 'women were emancipating themselves from the vanity and pettiness that have so long enslaved them.' I had to smile sadly at these words. This woman believed every word she said, no doubt, but she talked from theory. I had been in that world she spoke of; she had not. And take my word for it, that, in spite of all the march of progress pictured so rosily, men are still men, and women are still women. And just as long as they remain so, there is an absolute danger for any girl in the intimate, free-and-easy life of a newspaper office — a life from which social restraints are in a very great measure removed."

But I fancy I have quoted enough from the letters along this line. It will be seen that none is radical. The statements are conservative, as is likely to be the case where statements are based on experience. Rather than give more of the same tenor, I will give extracts from the letters of the three writers who answered affirmatively: —

From a long and varied experience is this written: —

"I would have no objection to my daughter entering the office of a reputable paper that does not sacrifice everything to sensation. The associations in such an office are pleasant and helpful, and the men are uniformly courteous and respectful to a girl who, in turn, is self-respecting, gracious, and, above all, womanly. I should insist, however, that her duties be well defined, and that she take none upon herself that would lessen her self-respect. It is in her power to do this, for if an editor finds that a girl is steadfast in her determination, and if she has proven that she can do the better class of work so well that he prefers to trust it to

her rather than to another, she will find no difficulty in making herself so busy that she has no time even to have the other work suggested to her."

This also is from a woman who "ought to know": —

"If a girl has brains, health, great strength of character, and clearness of head, I should say: 'Yes.' But all these are essentials. Reserve and dignity form the armor of the successful newspaper woman. She must expect from her men associates none of the courtesies of the drawing-room, and she must make them understand from the first that they may expect from her only the perfectly cool, professional manner a business woman should wear. Let her drop this, and she cheapens and lowers herself at once. A newspaper office is a busy place, where there is no time for nonsense, flirtations, or 'affairs.' Newspaper men prefer to respect their woman associate if she will let them. And if they do respect her, they will offer her no attentions she should not accept, say nothing she should not hear, and offer her no 'assignment' she cannot undertake. A bright woman, with good health and uncompromising self-respect, can find a splendid field of work in journalism."

The third opinion comes likewise from a newspaper woman of reputation and experience: —

"My best education and happiest experiences have come to me through my newspaper work, and I should be proud to see my daughter a modern newspaper woman of the best type — that is, a lady, governed by the same inbred laws which govern a lady under all circumstances, one who holds her pen in a womanly, that is to say, in a reverent, fashion, and who remembers that truth and kindliness are not alien to clever writing."

Then I wrote to fifty newspaper men, — all editors-in-chief, and managing editors who employ girls and women, — and asked them the same question. I selected the editors of the fifty most reputable newspapers in the country. Thirty replied — the majority fathers — and in each case was the answer most decided in the negative.

One, who employs twenty women on his staff, says: —

"I would rather see my daughter starve than that she should have ever heard or seen what the women on my staff have been compelled to hear and see."

From an editor at the head of one of the largest dailies: —

"No, a million times no, and no words I can command can make my objections appear strong enough."

An editor whose name is respected wherever known, says: —

"In my eighteen years of experience in this office, I have never yet seen a girl enter the newspaper field but that I have noticed a steady decline in that innate sense of refinement, gentleness, and womanliness, with

which she entered it, and we are extremely careful, too, in the surroundings of our women and their 'assignments.' Yet they lose something — what, I cannot say in words."

Another editor emphasizes the same point: —

"You may ask, 'Is there nothing good in Nazareth?' Oh, yes, there are women who have been strong enough to resist temptation in whatever form it may appear. But even they, I notice, have lost a little of their sweetness, a little of their womanliness, and a something — an intangible something that I cannot explain, but which I saw only the other day on the face of a woman who, five years ago, was the daintiest, the prettiest, and the most womanly creature that ever started out on the hard path of the reporter."

One of the leading editors of the West sent this reason: —

"I have been so impressed that girls have no place on the staff of a newspaper, that within six months I have cut down the number of woman editors and reporters from twelve to two, and these latter leave us next month. Entirely aside from the loss to themselves which the life entailed, I found they disorganized our reportorial force, the men often covertly doing the work assigned to the women, and the women turning the 'copy' in. This may have been gallantry, but it was not business."

From an editor of high standing came this: —

"Young womanhood is too sweet and sacred a thing to couple with the life of careless manner, hasty talk, and unconventional action, that seems inevitable in a newspaper office."

An editor of an important paper sends a few statistics: —

"I am recalling eighteen really capable girls that I have employed during the past two years: Four got married and each was glad to leave the work; six broke down in health and were not allowed to return to the work; two are now in a sanitarium; two got to be so 'swagger' that they could not fitly represent a paper of our standing, and the four others are with us now. There is a story of fourteen out of eighteen — all nice, capable girls."

Another editor writes, and with his words I will end: —

"It 'depends upon the girl,' it is said. And it does. But so much depends upon her, she is asked to carry so much, she is required to be so everlastingly on the defensive, that there isn't one girl in twenty who can safely steer across all the rocks she meets. And even if she does, I do not see how it is worth her while. We are supposed to pay our women better than any other paper in New York City: yet of the lot, the highest paid receives only forty-two dollars a week. She is generally credited as getting one hundred dollars a week, but, actually, she gets what I say, since I pay her each Friday. And hers is an unusual success."

I have tried to give, in these extracts, the most salient points in the seventy odd letters before me — the points differing as widely as possible so that the various phases of newspaper life, as it applies to a woman, might be touched upon. The opinions come from the best known women and men in the profession; the writers, workers, and editors, who stand highest in the newspaper world of to-day. And as opinions of that authoritative class, I present them to the girls who wish to work in newspaper offices, and to their parents who ask whether such an office is the place for a girl. It has seemed to me to be the most honest and most effective way to answer the questions which have come to us.

# QUALIFICATIONS OF A GOOD STENOGRAPHER

A GOOD stenographer should have a thorough mastery of many other things besides the art of writing shorthand. Speed in writing is an essential condition of good work, but is only one of several conditions which are equally essential. There is nothing more discouraging to a hurried man of business, or to an author, than to engage a stenographer who does not know how to spell words of more than two syllables, who does not know how to punctuate, and who has no idea of the formation of sentences.

Taking up the question of speed, there is a great difference in the requirements for a clerk or secretary and those for a reporter of public speeches and proceedings in court. The speed of stenographers may be divided for convenience into four grades, although the differences are only questions of degree. A beginner should be able to write at least seventy-five words a minute without feeling hurried, and should seek a position in a business house where the letters are simple, and relate to a single subject, rather than a position where literary knowledge is likely to be required. The most discouraging step in learning stenography is the attainment of this speed of seventy-five words a minute. It requires not merely knowledge of the characters, but instant knowledge. There is not time, when one is taking dictation, to stop to think what is the proper curve for *f* or *st*. Constant practice, combined with intelligent study, is the only means of attaining this readiness. Some teachers advertise to teach shorthand in a few weeks. All such claims are more or less misleading. The principles can be learned in that time, but proficiency, even up to seventy-five or one hundred words a minute, can hardly be attained without pretty constant practice for six months or longer.

After seventy-five words a minute can be written with ease, a higher speed comes rapidly with practice, and with the study of word signs and phrases. When a speed of one hundred words can be attained without difficulty, the stenographer may properly be classed in the second grade, when he or she is competent for most classes of office work. A business man or author will usually be content with this speed in dictating letters and articles, unless he is one of those persons,—entirely ignorant of shorthand,—who imagine that any person bearing the title of stenographer can write at the greatest speed attainable by human utterance.

When a stenographer can write one hundred words a minute without difficulty, he may begin to think of entering the ranks of stenographic reporters. For newspaper work, the speed of one hundred words will serve many purposes in reporting. It will not insure verbatim reporting in all cases, but will come pretty close to it. Many public speakers do not exceed one hundred words a minute, and those who go beyond an average of one hundred and twenty-five words, take their place among rapid speakers. The reporter who is capable of writing one hundred and twenty-five words without difficulty is pretty well qualified for newspaper work and for reporting public meetings. When it comes to court work, however, a stenographer writing only one hundred and twenty-five words a minute will break down, and make a bad mess for the judges and attorneys who rely upon his report.

The reason for requiring high capacity in a court reporter is not merely that he must catch every word and put it down legibly without fail, but because here conversation is much more rapid than in public speaking. A reporter capable of writing one hundred and twenty-five to one hundred and fifty words, and who has been reporting only formal addresses, will be astonished at his incompetence when he attempts to *report a running conversation between two people.*

Competent court reporters must be able to write one hundred and fifty words a minute, without effort. While this speed is a fair test of competence for court work, the best reporters, upon whom the greatest reliance is placed by great corporations and other valuable employers, can usually, under the spur of necessity, go considerably beyond one hundred and fifty words. Some can even write two hundred and fifty or three hundred words. The beginner, however, who has attained one hundred words, need not despair at the contemplation of this high speed. It is not so much a question of speed, between one hundred and twenty-five and one hundred and seventy-five words, as it is a question of brief phrase signs. Some of these are contained in the books, but others will be framed by the intelligent stenographer for himself, according to the nature of his work. Some increase in actual speed of movement is necessary, even for expert stenographers, in order to attain a speed of two hundred and fifty words a minute, and it is rarely that this rate is required for any great length of time. In seeking to increase speed of movement, care should be taken to avoid becoming « flustered.» Long, sprawling characters, written with breathless effort, will not give such good results in number of words written as will small characters, more deliberately recorded.

All that has been said about speed is subject to the condition that every word written must be easily read. Many beginners in short-

hand make the mistake of writing under severe nervous pressure, in order to attain high speed, with the result of finding themselves unable to read their notes after they are written. Such a stenographer is worse than useless to the business man or author. He has lost the entire time employed in dictation, and has nothing to show for it. The beginner might as well resign her position, as to appeal to the person who has dictated the letter to fill frequent gaps in her capacity for reading her notes. This may be done occasionally for a single word or phrase, but if done often, is likely to convince her employer that he needs a new secretary. It is much better for a stenographer who has an intelligent employer to ask him to moderate his speed in dictation, than to put down notes which cannot be read, or to skip along, catching only a part of what is dictated. Blunders which have cost much money have been made in business houses by stenographers who followed the latter plan, and trusted to luck to make the letter convey the meaning which was intended.

One of the reasons why some stenographers are unable to read their notes is their unwillingness to go to the trouble of trying to read them when they are practising. It is not necessary to read everything one takes in practice, but enough should be read to satisfy the student that he or she can read with absolute accuracy every word that has been written. Proper practice in reading is as important as in writing. Both in business and in court proceedings, the stenographer is often called upon to read a portion of what has been written. The competent stenographer should be able to do this without nervousness or hesitation.

A stenographer fully equipped in what may be called the mechanical details — ability to write rapidly and to read correctly — will achieve but little success if he or she does not possess a thorough English education. This involves not merely the correct spelling of ordinary words, but a knowledge of words which are somewhat technical. It cannot be expected that every stenographer shall be familiar with geometry, medicine, geology, chemistry, finance, and the higher mathematics, but the more he knows about them the better he is equipped. It is very discouraging to an employer having serious literary work to do, to find a stenographer who never seems to have heard the ordinary words of business and of polite literature, or who sees no relation between the subject discussed and the words used. A type of this sort of shorthand writer was the young lady who in writing out an article on the stock market, substituted for "watered trust stocks" the charming sylvan phrase, "watered cress stalks."

As shorthand writing depends upon the ear, mistakes cannot always be avoided. The great difference, in such matters, between a com-

petent and an incompetent stenographer, is not so much delicacy of hearing as good judgment. A beginner with good judgment will soon learn what her employers are writing about, and will not make nonsense out of an article on the stock market by introducing something having no relation to the subject-matter, simply because it "sounded like it." In the case just stated, the error in hearing was excusable, but the stolid writing out of a phrase so irrelevant showed lack of intelligence and judgment. Lack of technical knowledge can soon be corrected in a stenographer having a liberal English education and possessed of good judgment. The words used will be understood, and will soon become familiar. It is a great mistake, however, for girls who have barely learned the rudiments of English to start out as stenographers, unless they take care to get places where the letters are simple and of uniform character, and where literary correctness is not especially sought.

A young girl with a meager English education, lacking the knowledge of ordinary words which are used in business and in social circles, will make a failure of shorthand work, whatever speed she may have attained.

It may be said that the education of a stenographer is like that of a lawyer — the more things he knows, the better equipped he is for his work. Sound judgment is more essential, however, beyond a certain point, than is mere technical knowledge. A stenographer who has good judgment will soon be able to make himself appreciated in a business office by relieving his employer of many routine duties. He will become so capable that a sentence of general instructions as to the nature of a reply will enable him to compose the reply in proper form, of his own motion. A thorough acquaintance with the business may fit him in time to become a valued assistant in some work other than the mere transcribing of business letters.

Intelligence and good judgment are especially necessary for the reporting stenographer and the court reporter. In reporting public addresses for the newspapers, or for any other purpose, a stenographer who is sure of his ground may properly correct trifling grammatical errors made by *ex tempore* speakers. His object should be to present what the speaker meant to say, rather than to photograph the infelicities of grammar and construction which may have dropped from his lips under the nervous pressure of offhand speaking. The stenographer should be careful, however, not to undertake such corrections upon a scanty knowledge of the subject, or to attempt to force his own forms of expression upon the speaker. Amendments of this character cannot be recommended to young stenographers, except in the case of the most obvious grammatical

errors, where the correction of a word will prevent the use of an awkward expression. Writers of greater age and experience may go farther in polishing up speeches, but must be governed to a large extent by their knowledge of the speaker. Some speakers who lack literary culture, and who are conscious of the fact, are grateful for very considerable corrections; others, who are satisfied with their own literary attainments, whether they are good or bad, are sensitive to changes.

It need hardly be said that neatness in work, thorough care of the machine, if a typewriter is used, and absolute discretion in regard to what occurs in the office, are vital requirements in a good stenographer employed as a clerk or secretary. The relations of a stenographer to his employer will necessarily place him in possession of much knowledge of the business and of the personal relations of the latter which are known to few other persons or to none. This knowledge should be treated as sacredly confidential, as it would be by a physician or a lawyer. It should not under any circumstances be made the subject of gossip, even within the family circle. Secrecy need not be carried to an absurd point, in discussing the nature and amount of one's work, but anything which the employer might prefer should not become generally known — should not find its way outside of the office through the stenographer. This is preëminently true of anything which might cause social scandal. If matters come to the knowledge of the stenographer which he regards as improper, it is neither his duty nor his right to make them a subject of gossip. If he is asked to do anything which is contrary to his conscientious convictions of duty, he should give up his place; but this should not operate as a release from the obligation of shutting his eyes and keeping his lips closed regarding office secrets.

# WOMEN IN GOVERNMENT EMPLOY

There are eight great governmental departments in Washington: The State, Treasury, War, Justice, Post-office, Navy, Interior, and Agricultural; and, besides these, seventeen bureaus of lesser importance. So many people are employed in these departments, that were they all to be transported suddenly to the broad prairies of one of the western states, they would number enough to make a flourishing little city of themselves. In round figures, Uncle Sam employs twenty-five thousand of his sons and daughters to carry on the business of the government at the capital; and out of these, ten thousand are his daughters.

It is a comparatively recent innovation for women to occupy government positions. Before the Civil War, such a thing was unheard of. Sometimes, when the work was very pressing in the Patent Office, copying was given to women to do in their own homes, but even this was unusual. When General Spinner, who served with such distinguished honor as United States treasurer, from 1861 to 1875, came into office, he found himself hampered for want of help. The young men of the country were in the army and navy, and the business of the Treasury was in arrears. When he was a banker, he had learned that his daughter could be of much assistance to him in his bank; so in this dilemma for workmen at the Treasury, he determined to fill the vacant places with women. At that time, the legal tender notes were trimmed by hand with long shears which, with one stroke, cut across a sheet of four notes. Young men had been doing this work, and it was there that General Spinner wanted to substitute women. To demonstrate the feasibility of the plan, he made the experiment of engaging a young woman — Miss Jennie Douglas. He gave her a pair of the big, unwieldy shears, and set her to trimming the legal tenders. The very first day she proved the wisdom of his plan, cutting more neatly and more swiftly than any of the men trimmers, and settling the question unalterably in favor of her sex. Shortly afterward, seven other women trimmers were engaged, and the next year the number was doubled.

Steadily, since then, women have been proving their fitness for government positions, until now there is scarcely a division in any of the departments where they are not occupying places of trust. The Treasury was the first to open its doors, and has always had a larger proportion of female clerks than any other department. Of its present force of four thousand six hundred and sixty-two people, two

thousand and six are women, a rating far higher than the general average. These two thousand and six women range in age from sixty-five years (although there are but few so old), down to girls of eighteen; and it might be added, also, that there are not many so young. The highest-paid woman is a clerk in the Internal Revenue division, who receives eighteen hundred dollars annually. Next to her, in point of salary, are twenty-eight women who draw sixteen hundred each, and two who are paid fifteen hundred; there are ninety-six who receive fourteen hundred, two at thirteen hundred, and two hundred and six whose annual pay is twelve hundred dollars. The salaries of the remaining sixteen hundred and sixty-one range from that amount down to two hundred and forty dollars, which is paid to each of the one hundred and forty charwomen, who keep the marble halls and handsomely furnished rooms in immaculate condition. They all work side by side with men, doing the same work, as a general thing, and doing it as well.

Women with Brains in Their Fingers.—In the Redemption division of the Treasury, the women are doing a work that has won for them a world-wide reputation for expertness. All paper money, of whatever description, that has ever been issued by the United States Government, must be returned to the Redemption division, when it becomes mutilated or worn out, and Uncle Sam generously gives brand new bills for those that are not injured beyond recognition. When such money is returned to this division. it is examined for counterfeits, or other frauds, passed on by the clerks in charge, and then canceled and destroyed. It frequently happens that money which has been chewed up by animals; money that has been burned to a charred and blackened crisp; and money that has been buried with the dead until it has become offensive in the extreme, is sent in for redemption. Such money is examined by a committee of three women, who are among the oldest female employees in the service: Mrs. L. E. Rosenberg, Mrs. W. A. Leonard, and Mrs. A. E. Brown. The last named is the burnt-money expert; Mrs. Rosenberg looks after the mutilated notes; and Mrs. Leonard detects the "green goods" bills which are so warily slipped in with the true ones to be redeemed.

The proficiency that has been attained by these women is marvelous. Every bill that was ever issued by the government is familiar to them, and the very touch often determines the denomination of a note that is injured beyond determination in any other way. All of the fifty women who hold positions in this division are exceedingly skilful, as of necessity they must be. Millions of dollars pass through their hands annually, and each package bears the name and number of the examiner; if a mistake is made, the amount of it is charged

back to the one who made it, and deducted from her salary. In consequence of this system, mistakes are of rare occurence, but the responsibility is stupendous; and, within the past dozen or fifteen years, twenty-two of the clerks engaged in this division — both men and women — have had their reason unbalanced, and have become either temporarily or hopelessly insane.

Judgment That Is Unerring.— The Interior Department employs the next largest number of persons, and under that name are the Patent and Land offices, the Pension, Educational, and Indian, bureaus, the Geological Survey, and several other similar branches, in all of which there are about a thousand woman clerks. In the Indian Bureau, Miss Estelle Reel, of Wyoming, is the superintendent of the Indian schools, and receives a higher salary than any other woman in the government service. Miss Helen F. Shedd, of New York, the private secretary to the commissioner of patents, stands next to Miss Reel with reference to salary, receiving eighteen hundred dollars.

The experts in these offices are found among the examiners, inspectors, and draftsmen. There are five woman examiners in the Patent Office, and they attained their positions through the hardest of competitive examinations. These examinations occur annually, and are given by number, in order that the sex of the applicant may not be known. They include a comprehensive knowledge of the sciences and patent law. These women sit at their desks all day long, examining into the intricacies of every kind of machinery, electrical appliances, trade marks and designs, engineering, and so forth, and their trained judgment is as unerring as that of the men who sit at the desks opposite them. Miss Sarah Noyes, of Connecticut, is the oldest in the service of woman examiners, and her work is in electrical appliances. Her twenty years' experience has made her an accepted authority in all matters pertaining to this department.

In the War and Navy departments, there is a smaller per cent. of women than in any other, and the salaries, generally speaking, are not so high. This may be explained by the fact that so many of these positions fall naturally to men and officers who have served in the army and navy. The Post-office Department has about a thousand persons on its pay-rolls; less than a third of these are women, but their salaries average well. Sixteen hundred dollars is the highest remuneration, and there are ten women who receive this sum; nineteen others are paid fourteen hundred, while thirty-nine receive twelve hundred annually.

The "Blind Readers."— The Post-office Department is one of the most interesting divisions, and in it are employed two of the

most brilliant experts in government employ. This division is the Dead-letter office. In one corner of the big room, at two desks forming a hollow square near a window, sit these experts, who are without doubt the two greatest decipherers of chirography in the world. They are Mrs. Patty Lyle Collins, of Mississippi, and Miss Caroline Childs, of Nebraska. Every letter, the address of which is illegible to any local postmaster, is sent to the dead letter office, and as many as eighteen hundred to two thousand per day are turned over to Mrs. Collins and Miss Childs. It is a remarkable fact that, without being opened, eighty-seven per cent. of them are correctly readdressed and forwarded to the parties for whom they were intended. Letters are received here whose illegibility beggars description, and letters come without any address whatsoever; there are letters with only the street and town; and letters addressed with phonetic spelling; and letters in which the association of ideas causes the sender to write "Fish City, Massachusetts," when Gloucester is meant. The ability of Mrs. Collins and her assistant to see what was in the mind of the writer — but assuredly not in the address on the envelope — has won for them the title of "the blind readers," a title they certainly deserve. It may be inferred that both are blessed with an unusual amount of woman's intuition; but, added to that, is a marvelous memory, which has been taught to retain everything it sees or hears, and an almost inexhaustible supply of general knowledge. Of course, they have directories and books of reference to assist them, but their long experience is the secret of their proficiency and success.

At the Agricultural Department, in the southern part of the city, and at the Bureau of Public Printing, on the east side, fully twenty-five hundred women are employed. In the former place, the salaries paid are about what they are in the Post-office, while in the Printing Office the women work — as the men do — by the hour, and their wages vary according to their dexterity. In the Department of Justice are only a few women typewriters and stenographers, and while the State Department has fewer employees than almost any other, yet a fair percentage of these is women. This is an exceedingly desirable bureau with which to be connected, as the work is of a high class and is of itself educative. The secretary or chief clerk, Miss Mary Greer, of Washington, has earned her present high position by her own unaided efforts and decided executive ability.

Order from a Chaos of Correspondence. — For several years, a part of the work of the Department of State had been running behind, and when Mr. Day became Secretary, its unrecorded correspondence was piled several feet high in a storage closet, and he advised that the "Book Typewriter" system be adopted for recording it. He asked the

company to send up one of its best clerks to demonstrate the practicability of the plan. Miss Greer, who was then in its employ, was detailed for that work and in a few days she not only convinced the department of the feasibility of the plan, but also that she was just the person to reduce to order the chaos of correspondence. She was offered the position and accepted it, and in a few months had brought the correspondence up to date, and has kept it there ever since.

Downstairs, in the same building, is another young woman who is an expert, Miss Maud Stalnaker, in the Division of Consular Reports. Miss Stalnaker was educated in Paris and in Germany, and has a good command of French, German, Italian, and Spanish. A year or so ago, when a special examination for translator was held by the Civil Service commission, she and three men took it. Miss Stalnaker was the only one of the four who passed. Her sex, however, kept her from being appointed to the translator's position, and she was given her present place as a compromise. In this, her knowledge of the languages comes into play in editing the consular reports and in watching the foreign exchanges.

Invaluable Translators.— The highest-paid women translators are in the Bureau of American Republics. This bureau manages the business relations between the South and Central American republics and the United States, and expert translators are in demand. There are seven young women employed here, and two of them, Miss Kirk and Miss McNaughton, translate six different languages and receive salaries of twenty-five hundred dollars per year. They are both unusually gifted and have remarkable powers of concentration. Miss McNaughton was one of the translators for the Peace Commission in Paris, and Miss Kirk is said to be one of the finest translators of Portuguese in the United States.

It is often asked what prospect there is for a young woman to secure a good paying position in the departments at Washington, and I repeated the question the other day to the head of one of the bureaus. "A government position means a humdrum existence," said he, "and women find it more irksome than men. In the higher positions, they are not as well paid as men, for the reason that they do not give themselves the time to fit themselves for those positions,— not because they are women. There will always be places for excellent scientists, cataloguers, linguists,— experts of various kinds, regardless of whether they are women or men. There are hundreds of people of mediocre ability and attainments who want positions in the government service, hundreds more than there are places for, but it is true there, as it is in all other vocations of life, that there is plenty of room at the top.

# ADVICE TO DRAMATIC ASPIRANTS

*By ANNIE RUSSELL*

I HAVE been asked to express myself regarding the stage as a vocation for the average young woman, not the especially gifted, but the girl who holds, say, a normal school diploma, is fairly good-looking, healthful, ambitious, reputable, and the owner of a reasonable amount of sound, common sense,—just the kind of girl, in short, who, if she did not adopt the stage as a means of livelihood, would make an excellent typewriter, a trustworthy saleswoman, or a good little housewife.

Now it is impossible to forecast that which might or might not happen to such a young woman, in the event of her obtaining a footing on "the boards." The dramatic profession is one of surprises, and the only thing I can do, therefore, is to indicate the qualities which an aspirant to histrionic honors should possess, and add a word or two regarding those aspects of professional life that constitute its drawbacks.

First, then, the would-be actress must have a well-proportioned form, and a face that, if not precisely beautiful, should at least be mobile and pleasing. If she is not thus blessed, she may as well abandon her intention. Nothing will compensate her for a lack of physical attractions.

Next, she must possess temperament,—the receptive faculty that readily responds to impressions of the eye, ear, or mind. The emotional side of her nature should be well developed, and completely under control. The faculty of imitation is greatly to be desired. This can be cultivated, provided it exists to a reasonable degree in the first instance. Lastly, she must have magnetism,—that mysterious something which is as indefinable as it is actual. Without it, she cannot hope to rise above mediocrity. Just what this much-disputed charm is, I am not prepared to say. It may be the outcome of a well-balanced development of the other essentials, or it may be outside and independent of these. But it is an actuality, nevertheless, and I need not add that the successful women of the stage are those who have it in a greater or less degree. Here, again, direct work on the stage is needed, to prove whether the novice is or is not blessed with it.

Given all these, the next thing needed is opportunity. In this connection, I would strongly advise our hypothetical young woman to begin her life on the stage at the very foot of the ladder. If she is content to do this, she will at least be in a position to test her abilities. I went on the stage when I was eight years of age, and any measure of success that I may have achieved is based on the humble work of those earlier years.

Having obtained her footing, that which follows will depend upon herself. To the qualities that I have enumerated she must add a capacity for work, a persistent belief in her future, and a determination not to be overcome by set-backs.

The so-called temptations of the stage exist, it is true, but surely in no greater degree than they do in the store, the office, or the workroom. The girl who goes out into the world must realize that the safeguards of home life are no longer possible to her. The rest remains with herself. Virtue is not a matter of environment. The lives of scores of our actresses are a sufficient refutation of the ancient superstitions regarding the alleged evil influences of the stage.

Would I recommend the stage as a vocation for our average young woman? My reply would depend upon her individuality. Speaking for myself, I can only say that the longer I am in the profession, the more I realize its possibilities, and the more I love it. Perhaps this will serve as an answer to this last query.

# PRIVATE SECRETARIES

In the archives of the past, shrouded in the mists of antiquity, may be found suggestions that women were the transcribers of the records of those remote periods. The skill of women in handling the implements of writing seems to have been recognized, to some extent, even in the early ages, and it may not be far wrong to suppose that this was the beginning, or at least the foreshadowing, of the employment of women as assistants in the lines of work requiring legible penmanship, and, later, when correspondence had become a necessary element of business and social life, as private secretaries.

A private secretary, as the term indicates, holds a position of trust. This position may be with the head of a business house, with a professional man or woman, with a person of wealth, or with a man in official life. In a general way, the duty of the incumbent in any one of these positions is the care of the correspondence. Each line of work, however, has its special requirements.

In the office of the head of a business house, a private secretary is expected to become closely acquainted with the details of the business that is carried on under her employer's direction. This enables her to classify the mail daily, to refer each letter to its proper department, and to arrange all memoranda brought to her by the heads of the different departments, in answer to the letters referred to them. This knowledge of detail also makes it possible for her, with the aid of a single word or sentence, indicating the general tone of the reply, to answer a large portion of each day's correspondence without more definite dictation. In this way she relieves her employer of a great amount of labor.

In addition to these duties, the private secretary in many offices is required to meet the numerous callers who seek an interview with the head of the firm. Few busy men have time to grant a hearing to every one who comes to see them during business hours, but it is important that they should know the object of each caller. This the private secretary ascertains, and presents to her employer in as brief a form as possible. In a position with a professional man or woman, the duties are similar. A knowledge of stenography and typewriting is almost always necessary, and experience in keeping accounts is sometimes expected. Occasionally, some technical knowledge of the particular profession is desired.

A private secretary to a woman of wealth and social position, may be required, besides doing her work as correspondent, to keep her employer's visiting lists, her charity accounts, and a list of her social engagements and obligations. A woman well versed in formal etiquette, and with a wide social acquaintance, would be especially valuable in a position of this kind.

An official secretary has only the care of the correspondence. This is almost always heavy, as hundreds of letters are received daily. All of these must be answered, a great amount of data must be collected, and many of the letters require personally dictated replies.

In general, this occupation seems to be a natural and an attractive one. The work, while it may be difficult and at times laborious, is usually done amidst pleasant surroundings and under favorable conditions. The hours, though not always defined, or closely adhered to, are seldom of unreasonable length. The demand for women for private secretaries has increased in recent years. It was formerly thought that women could not adapt themselves to the requirements of a business office. They were supposed to lack the qualities essential to success along practical lines. A deeply-rooted belief also existed that women were unable to keep a secret, and for this reason were unfitted to hold positions of trust. Experience, however, has modified these prejudices to a great extent, and there are to-day no more trustworthy employees in any line of work than the women who hold positions as private secretaries.

The salaries paid to private secretaries vary in different cities and in different positions. An income of from seven hundred to nine hundred dollars a year might reasonably be expected by a competent secretary.

To the woman who wishes to become a private secretary, a good practical education, especially in the English branches, is absolutely essential. If this is supplemented by a knowledge of stenography and type-writing, her services will be considered more valuable, and she will probably be able more easily to find an opening. After preparation, the first step might be to seek employment as stenographer in some business office. The training and the experience there gained would help to determine the fitness of the worker for the desired advancement, and would aid materially in securing the higher position.

# OFFICE COPYING

BEFORE the advent of the type-writing machine, office copying was unquestionably a more distinctive vocation than it is now, and the work was done by both men and women. One of the chief qualifications at that time was rapid, legible penmanship. Notwithstanding the revolution brought about by the perfection of the type-writer, however, the occupation of office copying retains a sufficient number of distinctive characteristics to entitle it to a classification by itself.

The phrase "work of a mechanical or routine nature," must be interpreted as meaning only such work as the addressing of envelopes, which is purely mechanical. It is not easy, however, to draw the line between work that is routine and that which is not. In office copying, the subject now under consideration, there is very little work that does not call for some degree of technical knowledge on the part of the clerk of the business with which the copying is associated. In a pension attorney's office, for illustration, while there will be a certain amount of mechanical work, most of the duties of the clerk will involve discrimination and original thought. All papers relating to a given "claim" are kept in a folder. On this folder appears the number of the claim, and the claimant's name; and then, in allotted spaces, a digest of the claimant's letter of application, action taken, etc., etc. Each digest must contain all the salient points of a perhaps long and rambling letter, and the task of selection, and discrimination, is a part of the copyist's work. After long experience, the copyist may be required, because of the knowledge he has acquired in connection with a claim, to assist, personally, in its settlement. It may be held that here the work has passed beyond the bounds of mechanical copying, and so it has, but it is still "routine" in its nature, and the illustration brings out the point we wish to make, namely, that office copying, in modern usage, practically does not exist, except in connection with the technical work of a business. The time was when the field of simple mechanical copying was not so limited, but since the advent of addressing machines, and book-type-writers, now used in county recorders' offices for copying deeds, mortgages, and other documents, this class of work has become, very largely, a thing of the past.

The requirements which an office copyist is compelled to meet may be gleaned from what has already been said. A good, native intelli-

gence, a natural aptitude for determining what is valuable and pertinent, a good idea of order and punctuality, are, of course, the first essentials. Any bright woman with a good common school education need not hesitate to take up the work. Naturally, she will have to begin at the foot of the ladder, as the saying is, with small duties and small pay. The higher grade work, with better pay, will come with experience and faithful service.

It is difficult to speak definitely regarding the remuneration of copyist clerks. Everything depends upon the experience and technical knowledge possessed. The range may be placed at from three to eighteen dollars a week, the average being perhaps about nine dollars. Those beginning at the bottom, addressing envelopes, say, cannot hope for a salary greater than three dollars a week. Experiments have proven that in large cities, a single advertisement in a daily paper, offering three dollars, and even less, for this kind of work, will be responded to by a great number of applicants. However, those intending to take up the work should not be daunted by this, for ability, and faithful service, will open up the way to the higher positions. An honorable and fairly good livelihood usually crowns intelligent, well-directed effort in this field.

# COPYISTS FOR LITERARY PEOPLE

Two conditions have contributed to the opening of this comparatively new, but remunerative, occupation for young women. One of these is the notoriously illegible chirography of literary people, and the other, the almost universal rule of the publishers that manuscripts shall be type-written. The employment of a copyist by the writers of books, and of stories, has thus become necessary, and women have generally been chosen for such positions.

In this work, however, much more than mere ability to operate a type-writer machine is essential. The copyist must have a fair education; she must be able to correctly spell, punctuate, capitalize, and paragraph the "copy." Not the least important of the requirements is that she must have a faculty for reading obscure handwriting, a qualification that many educated persons do not possess.

Few authors are able to transcribe their thoughts, with their own hands, directly upon a writing machine; and an equally small number find it impossible to record them, satisfactorily, by dictation. There is a sympathy between the brain and the hand that moves the pen, which is lacking when the machine, or the voice, is used in composition.

There are many women employed in the large cities as copyists for literary writers, who work for two, or more, authors at the same time, such an arrangement being possible when the volume of manuscript prepared daily by the writers is not unusually large. For example, the copyist will be occupied in one study in the morning, and in another in the afternoon, and if she is exceptionally industrious she may also find occupation for her evenings.

The publishing houses also employ large numbers of women for this class of work. Some well-known authors whose manuscripts are desirable under any conditions or circumstances, and who do not care to employ copyists, are permitted to send their "copy" to the publisher just as it comes from their own hands. It is then type-written by one of the women employed for the purpose. This is done to minimize the inevitable errors of the composing-room.

It is a fact generally recognized by authors that a type-written manuscript is much more likely to receive consideration from a pub-

lisher than is one written by hand, regardless of the respective merits of the two. The women who do this copying receive a higher compensation than is paid for ordinary type-writing, and they undoubtedly earn it. The work is pleasant, however, and such positions are sometimes the stepping stones to better ones.

A young woman desiring to enter upon this class of work, and possessing the requisite qualifications, might secure a start by making personal application to some large publishing house, by advertising in the newspapers, or by obtaining letters of introduction to some writer whose influence might be used in her behalf.

# SCHOOL TEACHING

To be thoroughly fitted for school teaching means, ordinarily, the completion of a High school course, and from one to three or four years' work in the Normal school. It is sometimes possible to omit the Normal course, and even that of the High school, by successfully taking a general examination. This implies special private training in what are generally known as "teachers' preparatory schools." This training may be, and often is, quite as thorough as to essentials, but there is no denying the better general equipment acquired through the High school course, and the special ability to impart knowledge, derived from the Normal school work.


The underlying idea of education in America to-day is to make the elementary training very general, leaving specialization to the higher educational institutions. For this reason, teachers of the elements are called upon to teach such a variety of subjects as to make the possession of a broad basis of general knowledge almost imperative. Certainly, conspicuous success in the profession cannot be hoped for without such attainment. While, therefore, much of the work of preparation necessary to secure this basis of general knowledge may be avoided in the way indicated, it still must be patent that, to those expecting to make teaching a life work, and who hope to become leaders in the field, the work of the High school, and of the Normal school, is practically indispensable. The ideal training is that of a college, or university, education, followed by a training in the practical work of teaching that now obtains in our High schools, the teachers of which are usually drawn from colleges and universities.

So much for intellectual requirements. As regards physical requirements, the exactions of teaching are equally great. No woman deficient in strength and vitality should for a moment consider herself adapted to the work. The strongest constitution is taxed to the utmost. The mere presence of forty-five young people in the same room is a sufficient tax upon the strength of ordinary women. Add to this the care and worry incident to maintaining order, and to directing the work of these young people, and you have a task surpassing in wear and tear of body and nerves, that of almost any other occupation to which women are eligible. Nor is the work entirely confined to the schoolroom. In comparatively few cases is a teacher able to

prevent the schoolroom duties from encroaching upon time which should be spent in rest and recreation, at home. Lessons are to be prepared, compositions to be read, examination papers corrected, and reports filled out, so that the five or six hours of work in the schoolroom are extended to ten, and perhaps twelve, hours. The average teacher is not able to avoid these extra duties, and those taking up the work of teaching will, sooner or later, have to become reconciled to it. Our concluding advice in this connection is: Do not take up the work of teaching unless you are physically robust; and, once you take it up, endeavor in all possible ways to conserve your strength while at work; and while not at work, to abandon as completely as possible all thought of the schoolroom and its duties. The two or three months' vacation should be given up entirely to rest and recreation.

School-teaching as an occupation cannot be said to offer much in the way of remuneration. It is a well-known fact that teachers, and especially women teachers, are underpaid. The yearly salary ranges from a minimum of perhaps three hundred dollars to a maximum of ten, eleven, and possibly twelve, hundred dollars. The salaries for teachers vary of course in different states, and in different cities within a state. Probably the salaries of the great majority of women teachers range from six hundred to nine hundred dollars. This, speaking generally, is for ten months' work, and as the two months' vacation must usually, through necessity, be given up to rest, and recuperation for the coming year's work, it is scarcely possible for teachers to augment their earnings by labor during the months the schools are closed. The salary for the year is usually paid in ten equal payments, which necessitates laying aside a sufficient amount to cover the expenses of the months of enforced idleness. The salaries attached to supervisory positions, such as principalships, and superintendencies, are of course greater, ranging perhaps from twelve to twenty-five hundred dollars. But as has been pointed out, these positions are only in exceptional cases open to women. Seventy-five dollars a month, with two months of leave, with pay, during the year, is perhaps what the average successful woman teacher may expect to obtain in the way of remuneration.

The responsibility resting upon the shoulders of the school-teacher is very great. Children are quick to see any discrepancy between precept and action, and no teacher who does not live what she teaches can hope to exert a proper influence upon the character of her scholars. She lives constantly under the white light of public scrutiny, and no moral shortcoming can long remain undiscovered. Given true instincts and high ideals, however, this part of the requirements will prove no obstacle in her pathway.

# THE NURSERY GOVERNESS

*I am indebted to my father for living, but to my teacher for living well.*
—Alexander the Great.

The woman who selects as an employment the training of youthful minds and bodies, places herself under a twofold obligation—first, to the child, whose future life she may influence in a marked degree; secondly, to the parent who intrusts to her a charge so sacred. She should remember that next to the mother stands the teacher and nurse. The comfort and the happiness of her small charges are largely dependent upon her own actions, and between them and herself there should be a mutual sympathy and the clearest comprehension.

In order to achieve success as a nursery governess, much depends upon the woman's personality. She must be refined in taste, gentle in manner, and possessed of a high moral sense. She must have adequate knowledge of the laws that govern the child's physical, mental, and spiritual, development. She must possess a genuine love for children, and must be able to attract and to hold them. She should possess a fair education, and be quick to note the individual character of her charges.

The responsible duties of a nursery governess are, therefore, varied and numerous. She is not only expected to instruct the children in the rudiments of reading, writing, spelling, geography, and arithmetic, but she regulates their diet, and their hours for sleeping, and looks after them in illness. When she has the entire charge of the nursery, and the mother is unable to pay her more than a daily visit, it is desirable that she should possess some knowledge of the diseases of childhood, and of the simple remedies that may be useful before a medical attendant can be procured, or when such attendance is not considered necessary.

The training of the child's character is also a part of the duty of the nursery governess. Truthfulness, purity of thought, docility, and obedience, are qualities that must be awakened in the little one's soul. Only the teacher who possesses such attributes herself can successfully cultivate them in others. "If she would teach truth, she must be true, if she would teach honesty, she must be honest!" Childish minds are quick in detecting the slightest imposition, and quick to resent it.

Not only is it well for the governess to study the character of her charges, but she should mark, and faithfully report to the parent, the defects she observes in their dispositions; so that by united efforts, any evil propensity may be checked, or eradicated. Most children have some fault, of which they should be broken, but, little good is ever accomplished by harshness. Kindness, perseverance, and patience, on the part of the nurse or governess are here of the utmost importance.

Punishment, as far as possible, should be avoided, yet indulgence, and flattery, should be equally shunned.

Children are often irritating and unreasonable, but the governess must not give way to irritability. She must ever be gentle, self-forgetful, and considerate, yet must rule her charges with firm dignity.

In every occupation for women there arises the question of remuneration. In that of the nursery governess it would naturally vary according to the wealth and to the position of the employer, and also to the assistance given in the nursery by the mistress herself, or by the under nursemaid. Thirty to forty dollars per month is the average salary paid for this service, although under certain conditions, it is sometimes much higher.

The nursery governess differs from the ordinary governess in that she rarely, if ever, lodges apart from the house of her employer. Her room and meals are usually as good as the home affords, for she eats with her charges, and, as a rule, sleeps near them.

The hours are long, but the work should not be hard, and a regular systematic regard for the laws of health, of rest, and of occupation, will profit both the governess and those in her care.

Above all, let the girl or woman who desires to become the guide of little children, be sure that she is possessed of three qualities: an equable disposition, a patient, sympathetic heart, and an interest in, and a love for, her work.

Let her put heart into her work. Let her not look upon it simply as a means of earning money. If she can inwardly believe herself possessed of all these qualities and capable of many sacrifices, then she need not fear to attempt the work before her.

# KINDERGARTEN TEACHING

PRACTICALLY all that was said regarding the general subject of school-teaching, applies with equal force to kindergarten work. In this work, however, men play an even smaller part than in school-teaching generally. Where men engage at all in the work, it is on the theoretical, rather than on the practical, side of teaching. The reason for this is almost wholly a financial one, the salaries paid to kindergarten teachers being too small to induce men of even mediocre abilities to enter upon the work. Even the salaries of the directors of kindergarten teachers, are not large enough to attract men. The result is, therefore, that the field is left entirely to women.

The work of preparation for this field of teaching is almost analogous to that set forth under the general head of school-teaching. While the work is apparently simple, the method of teaching is such as to exact as complete an equipment of knowledge as is required of the teachers of grammar grades. The aim of kindergarten work is principally to stimulate observation in children, and to enable them to trace relationships between cause and effect in the various activities of life which surround them. To do this successfully, means that the teacher herself must have a thorough insight into life, and nature — an insight that is not acquired except as the result of a broad general education, and of a special training, corresponding to the normal school work of teachers in the higher grades. This special training is obtained in kindergarten training schools, the time involved corresponding in general to that of a normal school course. As with normal school work, the time spent in this special preparation may be cut down to a year, but this can be done only with detriment to the equipment, and therefore to the chances of successfully prosecuting the work.

Teaching in all its forms requires a great amount of preparation, and those choosing the kindergarten branch, as requiring less preparation than does the teaching of the higher grades, will quickly discover that they have erred. The minimum requirements in this direction may be taken as the completion of a high school course, and three years of special work in the kindergarten training school.

In one respect, the physical requirements of kindergarten work are not so severe as are the requirements in the higher grades. To a greater extent, the work of the kindergarten teachers is limited to the hours actually spent in the school-room. Then, too, each kindergarten teacher has an assistant on whom devolves much of the work of maintaining order. It is true that, the children being younger than grammar school children, a greater amount of individual care, and instruction, is necessary, and that, therefore, the kindergarten teacher is obliged to "give out more of herself," as the saying is, than do the teachers of the higher grades. Still, for the reasons given, the work of the kindergarten schools is probably less trying, physically, than that in the grammar schools.

As stated before, the salaries of the kindergarten teachers are very low, the range being probably from four hundred to seven hundred and twenty dollars a year. The work is usually begun at the minimum rate, the salary increasing a certain stipulated amount with each year's service. The assistants receive, ordinarily, three hundred dollars a year. In the cases of both teacher and assistant, the salary is usually for ten months' work. For those taking up an occupation simply as a means of gaining a livelihood, kindergarten work has but little to offer. To be successful in the work, a teacher's thoughts and energies must be centered in it. It cannot be taken up, and laid down, like the pen of a copyist; it must be lived, it must become, veritably, a part of the teacher. No one, therefore, not willing to devote every mental quality and attainment to the work, and to make sacrifices, both physical and financial, should entertain any idea of becoming a kindergarten worker.

# MUSIC-TEACHERS

MUSIC-TEACHING as an occupation seems to have a certain charm for a girl who looks forward to supporting herself by her own efforts. If she has musical taste, and talent for imparting knowledge, her thoughts often turn naturally in this direction. The work of music-teaching will demand natural gifts, thorough study, and close application; with these qualities, success in the work may be looked forward to with a fair degree of confidence.

After her decision is made, the young woman should decide whether she will teach vocal or instrumental music, and if the latter, what instrument shall be her specialty.

If vocal music is selected, a girl would do well to consult the best master of singing within her reach, who will tell her whether her voice has enough promise in sweetness and purity of tone, not necessarily in strength, to warrant the outlay of money, and of hard work, necessary to prepare herself for this line of work. "A good ear," that almost indefinable sense of perception of different tones, is important to the student or teacher of both vocal and instrumental music.

The selection of an instructor, or of a college, modified as it must be to some extent by the question of expense, is an important step. As in most studies, the best instruction that can be obtained is usually the cheapest in the end. A teacher who is known to be doing thorough, conscientious work, who inspires students to earnest efforts to develop the best in themselves, rather than to secure brilliant effects, is the most to be trusted, particularly with the voice.

A course in a good college or conservatory of music is held by many to be preferable to instruction wholly by private teachers. But a beginning might well be made before entering such a school. The expense of an entire college course might be lessened by a preliminary period of study at home, under a good teacher. In this way, a thorough knowledge of the rudiments could be acquired, and a foundation be laid for advanced college work. The length of a course varies in different conservatories, most of them requiring three or four years' study.

A student of singing is usually required to study the piano, and harmony. And she may learn counterpoint, and composition, if she is studying instrumental music, and wishes to become a master of her art. But piano, and harmony, and thorough work in sight reading, are valuable to those who intend to become teachers. All this may be learned

from private instructors, but the student would miss the assistance and the inspiration of class instruction and work, and also the many opportunities — offered to the pupils of a musical college — to hear the best music.

Whether a course in this country, or in one of the foreign universities, be the more valuable, is a disputed question. Thousands of women are to-day teaching both vocal and instrumental music thoroughly, and successfully, who obtained their education wholly in this country. There are many who occasionally spend a year in study abroad after having established themselves in their work here. These are usually the more progressive teachers, who believe that the ideal teacher never stands still; that if she does not gain new knowledge from experience and from study, she soon falls back into a grade of work that is mere drudgery, and lifeless routine, beneficial neither to herself nor to her pupils.

But practical considerations of expense govern largely the choice of many girls who study with the purpose of earning their living as teachers. The apparent additional cost of a course in music in Germany, France, or Italy, must often decide the question in favor of home instruction. Yet it is possible to live abroad, in a comfortable way, at a moderate cost. The price of music lessons, and the tuition in the schools, are apt to exceed the prices for the same instruction in this country.

The student at home, if she avail herself of the best that her instructors can give, and if she is willing to go through as much of the drudgery of practice as is required by foreign teachers, would no doubt be well equipped for her profession. On the other hand, a course abroad offers advantages to the earnest student, that are not always to be secured in this country. The culture gained by travel through other countries, and by contact with unfamiliar ways and customs, would be added to the special training in music, and any teacher will find that general culture and a broad education are of great assistance when her work actually begins.

Furthermore, the atmosphere of a foreign music center is tense with musical thought and feeling. Great musicians and composers are constantly giving their best to vast audiences of enthusiastic listeners. The student is awakened and stimulated, and, though sometimes discouraged, is usually inspired to do her best. The finest concerts are given at an extremely low price of admission, particularly to the pupils of the schools, a nominal fee of ten or fifteen cents admitting the pupil to the best that are given. And the opportunity to hear men and women who are masters of music, in vocal or instrumental work, is considered an education in itself.

After graduation from college or conservatory, or after the completion of a course with private teachers, comes the vital question of securing pupils, or a position in some school. To solve this question with success, requires patience, tact, and business energy. Work that is worth while seldom comes to those who wait for it without exerting themselves.

The smaller cities or towns are considered by some to offer the most promising field to the beginner who wishes to give private lessons. A woman whose home is in one of these smaller centers, might commence work in her own circle of acquaintances. Perhaps a series of recitals would best prove to the public, as well as to her friends, that her musical ability is genuine, and her preparation thorough. In a small place, a teacher could become well known in a short time, and she would have the advantage of less competition than in a large city.

In the large cities it is difficult, in this occupation, as in many others, to gain a footing. The competition is great, but experience shows that it is not by any means impossible for the teacher who is thorough to secure pupils. There is said to be a mass of useless material afloat in the musical market. This, however, may not always be the result of lack of musical ability in the teachers themselves. Some are careless in their work, some do not have business methods, others are without the essential element of « born fitness » for teaching. These disadvantages, however, are met and overcome by many beginners. Classes are formed, pupils are secured, and, possibly, schools are ultimately established.

If a position in a school is considered more desirable, it can sometimes be secured through an educational bureau, which usually includes a branch for music teachers. By the payment of a fee, or by an agreement to pay a certain percentage of the first salary, a satisfactory opening may be found through an agency of this kind. These educational bureaus simply try to bring demand and supply in touch with each other, and if the student has good credentials from college or teachers, and is prepared to go to any part of the country where there may be an opening, an application to such a bureau may settle the question of a beginning in her profession.

After the position, or employment, is secured, the real work of the teacher begins. Difficult conditions and serious problems may be met. Pupils are often trying, and parents may be exacting. Schools may require a great amount of work in return for a small compensation. The attitude of a teacher toward the disagreeable side of her occupation determines to a great extent the wisdom of her choice of a profession. If she is wise she will avoid extremes and fault-find-

ing. She will practise the fine art of adaptation, and cultivate sympathy and patience with human nature; especially in teaching children must infinite pains be taken.

A teacher imparts much to her pupils by her example. The genuine teacher, who will put her best into her instruction, will hardly fail to secure good results, gratifying to herself and to her patrons.

There are few occupations for women in which compensation varies more than in music-teaching. At the present time, women are earning salaries in this line of work, which range from very substantial incomes to an almost starvation wage. Private lessons in both vocal and instrumental music are given at prices ranging from twenty-five cents to five dollars a lesson. There are a great many competent teachers who are making a good living by giving lessons at two or three dollars each. The schools usually pay salaries varying from a few hundred to a thousand dollars a year.

In the smaller towns, it might prove to be best for a teacher to modify her prices to meet whatever conditions exist, for money in a small place is worth more than in a large city, for the reason that living expenses are usually less.

The necessity for adaptation to different localities and situations is, perhaps, a good test of a woman's business ability.

According to the views of many successful teachers of music, business habits are of more value than is actual musical skill. And they hold this opinion in spite of the fact that they thoroughly appreciate skill and training. It may be an extreme view, but experience shows, in many cases, that the teacher who is practical succeeds, and that the more she regards her work as a business, the more rapid is her advancement.

A departure from ordinary methods sometimes produces very satisfactory results. In one instance, a woman with a thorough knowledge of the piano, who was not only a musician but a teacher, opened classes for beginners, and taught them with profit both to herself and to her pupils. She had had some experience in kindergarten work, and she brought to her aid a blackboard and sets of noiseless keyboards. She taught only beginners, and limited each class to a certain number of pupils. The names of new applicants she placed upon a waiting list until a class could be formed. This enabled her to teach the children at a very reasonable price for each one, and also made it possible to keep each class with her for two hours daily. In this way all practising was done under her eye, and the usual faults of beginners who practise by themselves could be corrected. Working together stimulated the children to do their best, and aroused their interest and kept it from flagging. In this way, too,

the musical ability of each child could be ascertained for the benefit of the parents, enabling them to decide whether further education along musical lines would be advisable. This venture, which proved satisfactory and profitable, was made almost in the shadow of a conservatory of music of excellent standing, where pupils of all grades were taught.

The experience of this teacher, however, shows that practical business ability, and original methods, may well be combined with musical skill and with the power to teach. And those who have this power and skill deserve a high rank in their profession, for the teaching of children is no simple task. It has been said that a music-teacher who can interest a child, and who can make of him a player or a singer, can command any price she chooses to ask — that a gold mine lies at her door. However this may be, it can be said without exaggeration that a genuine teacher, who has fitted herself by earnest and thorough practice for her work, and who can impart by precept, and by example, both the spirit and the letter of what she herself has learned, need have little fear that sooner or later she will succeed.

# WOMEN AS INVENTORS

Women as inventors seem to be just as successful in this line as men. Men acquainted with the field say that fully seventy-five per cent. of the patents taken out by women in the last five years are yielding profitable returns. The woman who invented satchel-bottomed paper bags, for instance, had an offer of $20,000 for the patent before she left Washington. A simple glove-buttoner is bringing to the woman inventor an income of $5,000 a year. A woman clerk in a department store invented a parcel delivery system which netted substantial returns. One New England milliner, herself an inventor, enjoys the right to several patents that represent the ingenuity of the women operatives in her employ. She shares profits with the inventors, and one of the devices first put in operation in this factory brings in $20,000 a year.

It often happens that a woman employee, from familiarity with the machinery or business methods in use, thinks out some time and labor-saving scheme. She shows the model to the manager of her department. He tells the firm of its merits, and they arrange with the employee for the exclusive use of the invention. The employee goes on quietly with her work in the store or mill. The public never hears of her, but success has been a stimulus, and she keeps on the lookout for further inventive opportunity.

Much of woman's present activity in inventions is ascribed to the better educational facilities now obtainable. The college standard in high and popular courses in sloyd and manual training has taught women to use their hands as well as brains. Notwithstanding this, a large proportion of the more successful women inventors are those who have had only medium or limited educational advantages, but have been daily toilers in the various lines of industry. A Rhode Island woman invented an improved buttonhole-cutting machine that measures the distance between the buttonholes automatically, with much profit and convenience to garment-makers. A lock with three thousand combinations is a woman's invention; also a letter box for the outside of homes, that shows a signal when there is a letter inside for the postman to collect, an invention now in general use. A woman has just perfected a valuable apparatus for removing wool from skins, by electricity, showing that women are quick to adapt the modern facilities of the age to practical purpose.

The woman inventor must never lose sight of practicality if she would succeed. Other women brain-workers may at times indulge in dreaming and theorizing, but the woman inventor, however high her flights of fancy, must always come back to the practical. Many women's inventions are submitted to the patent office, accompanied by elaborate models, but so conspicuously lacking in some vital principle as to be unavailing. A good many are rejected on the score of absurdity, but, according to official testimony, the women aspirants do not differ from the men in this respect. Many women submit practical specifications and fail to score success not from lack of originality, but because the inventor was ignorant of previous patents covering the same point. No matter how brilliant an inventor's idea may seem, he is advised to search thoroughly the patent office records before making a model. Some women have taken out five or six patents for widely different purposes. A California woman whose first invention, in early youth, was a corset, has lately patented several inventions relating to reservoirs and irrigation.

The Northwest, the Middle, and the Eastern States have produced the most active women inventors. The South has yielded the fewest number, but the Southern women who have entered the field at all have been financially successful. Two important aids to agriculture were the invention of an Alabama woman. A working woman in North Carolina succeeded with a culinary invention. A Florida matron patented a useful car-heating apparatus. A Texas woman invented a novel folding tent, and another Southern woman a finger-exercising device of value to musicians. A Western widow patented a method of desulphurizing ores, another invented a composition solder of use to metal workers.

Women inventors from the big cities have almost invariably patented articles pertaining to the elegance of dress and house furnishings. Those from the country districts and villages have been active in the way of dress drafting patterns, novel devices for adjusting portières and curtains, and patents useful in the manufacture of artistic goods. Many facilities for clerical use have been patented by city women, such as safety envelops, improved typewriting appliances, copy holders, letter openers, etc. Most of these women were employed at some time as clerks in business offices and felt the lack of conveniences which they afterward supplied.

A number of women school-teachers are successful inventors, and have patented educational systems and devices, also kindergarten implements, erasers, school bags, and book rests. Women from the small towns in Wisconsin, Minnesota, Dakota, and Illinois, have been prolific

in inventing household conveniences, washing and cleaning apparatus, facilities for sanitation, garment bindings, shield fastenings, and dress improvements. New England women have brought out attachments and improvements that have to do with saddles, harnesses, and vehicles; also the needs of barn and garden. They have invented butter workers, plumbing appliances, brushes for cleaning, and fire kindling compositions, toys, games, puzzles, and amusement knick-knacks. A considerable proportion of the fakir's goods, novelties, and trick pastimes, sold on the streets, were originated by women. They promptly sell the patent right to the proprietors of news agencies, who include such small gear in their stationers' and confectioners' supplies. A fair proportion of the specialty goods inventors and makers are women. Many whose trade-marks are registered at the patent office have made fortunes, either through shrewdness in putting their wares on the market or because of the worth of the article. These inventions include patent medicines, complexion soaps and wafers, hair ointments and restorers, and an infinity of health and toilet knick-knacks found at the drug shops.

The first woman to take out a patent in America was Mrs. Mary E. Kies, who, in 1809, invented a process for weaving straw with silk or thread. During the next twenty-five years only fifteen patents were granted to women. In the next twenty-five years thirty-five patents were granted, and it was not until after the Civil War that there was any marked increase in the number of women inventors. There were one hundred and fifty-two models of women's inventions exhibited at the Atlanta exposition, and since then the patent office has had a specially classified list of women's inventions prepared for public inspection.

It has been said that a Georgia woman achieves success wherever she goes, and Miss Jennie McIntosh, daughter of Judge McIntosh, of the United States Court, in Florida, is no exception to the rule. A native of Savannah, Georgia, Miss McIntosh first went to work as amanuensis to a New York firm engaged in the business of transporting tallow. Her active brain and quick eye soon saw where an improvement could be made in the company's methods. She invented an automatic device for draining off the water which accumulated in the tallow-tank cars, and for her invention she received ten thousand dollars in cash and thirty thousand dollars in the company's stock, then worth twenty-five cents on the dollar. When the stock had run up to one hundred and fifty dollars, she disposed of her shares, and is now the possessor of a handsome fortune.

Women have invented many ingenious and valuable devices appertaining to the work of the household. One of the most successful

machines for washing clothes — of which hundreds have been patented, most of them valueless — was invented by a woman. A dish-washing machine, to lighten the drudgery of the housekeeper, is the work of a woman's brain. Strange as it may seem, this device does its work rapidly and thoroughly, with fewer casualties to the dishes than those which result from hand work. Hundreds of appliances for use in the kitchen, the laundry, and other departments of "housework," have been produced, or improved, by the inventive genius of woman. There have been hundreds of others, in the various spheres of activity in which women are employed. A person of quick perception who operates a machine, discovers its defects, and often devises an improvement which greatly increases the facility and correctness of its work. Similarly, one who, day after day, repeats a process of labor that may have been handed down through many generations, finds a way by which, with simple mechanical aid, the burden of toil is lightened. In this field much has already been accomplished by women, and much more is being done, as their faculties are sharpened and quickened by their closer contact with the actualities of life.

## DENTISTRY AS A VOCATION FOR WOMEN

Any young woman possessing intelligence, good health, and a liking for the work, may become successful in the field of dentistry.

The preparation for this vocation consists of a good general education supplemented by a course of study in some first-class dental school or college. Schools of dentistry are to be found in every leading city of America. The usual course is of three years' duration, and the cost of tuition, instruments, and other matters, exclusive of living expenses, will approximate $1,400 for the course. It should be remembered, however, that a considerable portion of this sum goes to pay for instruments that will furnish almost the entire outfit of an office when the student becomes a practitioner. In fact, with a student's supply of instruments on hand, the immediate cost of furnishing a dentist's office, on a modest scale, becomes insignificant.

Regarding the college course, the studies of the first two years are much like those taken up during the first years of a medical college course. Physiology, anatomy, and pathology, are entered into rather thoroughly.

After securing the desired college diploma, the next step to be considered is the establishment of a practice. The future success of the

woman dentist depends almost wholly upon the way in which she goes about this important matter. She should make it a point to utilize the good-will of her social acquaintance, especially if the cost of living for the first year or so is to her an important item. By securing patronage among her acquaintances, at the start, she can feel assured that if her work is thorough, it will not be many months until her practice is assured. One bright woman dentist who has achieved much success, acknowledges that during the first twelve months of her professional life she had but six customers. She was a stranger in the city where she had opened an office. During the second year her work proved more profitable, and within the third year she was looking forward complacently toward a yearly income of $3,000, over and above business expenses. This woman earnestly advises others of her sex to enter the field of dentistry.

It is her happy boast that she has never turned out a piece of finished work which was not thorough, and that she has never charged excessive prices; she is also proud of the fact that she possesses a goodly male patronage. In her opinion, men requiring the services of a dentist are inclined to favor the woman expert because of her superior delicacy of touch. The work on children's teeth is especially within her province.

# TELEGRAPHY

TELEGRAPHY was one of the first vocations in which women entered into competition with men, and, as such, is worthy of careful consideration on the part of the young woman who contemplates a professional career. In common with other occupations requiring a course of preparation and study, it has difficulties and drawbacks which should not be lost sight of in estimating its attractions and advantages. The work is not especially arduous, except, perhaps, in the largest offices, and the salaries paid are equal to the average of those received by women in other than what may be termed the strictly educational professions.

The number of women operators has increased enormously within late years, but this has not had the effect of driving an equal number of men out of the service, as is often asserted. On the contrary, there has been a corresponding increase in the number of male operators, which has resulted from the extension of telegraphic facilities necessary to keep pace with the public demand.

Before the invention of the duplex, quadruplex, and Wheatstone systems, when there were only a few wires between even the largest cities, the number of operators was necessarily limited to the corresponding number of single wires. As each operator was compelled to handle a very large amount of business daily, and as all operators were required to be expert in their work, very few women were employed at that time. To-day, if the business on a wire becomes too heavy for one operator to handle, the circuit can be duplexed or quadruplexed, thus multiplying its capacity, and bringing into service four, or eight, operators, instead of two. When the work is distributed in this way, the public is more promptly served than would be possible by even the most expert transmission on a single wire, while at the same time the operators are not required to exhibit phenomenal speed.

For the transmission of commercial messages, or long dispatches over a "through circuit," the operator must be able to endure a protracted physical and mental strain. The sending of dispatches over a line several thousands, or even hundreds, of miles in length requires the expenditure of a considerable amount of muscular energy. This does not mean mere physical strength, but rather sufficient endurance to enable him to withstand a tension of far more than ordinary severity.

Women are not physically qualified for this class of telegraphic work, which, by the way, commands the highest remuneration. In order to cause the Morse characters to pass intelligently over a very long wire, it is necessary for the operator to hold the key in an exceedingly firm grasp. Every dot, and every dash, must be formed with equal firmness, not merely for a minute, or for an hour, but on circuits for eight or nine hours at a stretch. It has frequently happened that all the wires between New York and Chicago were prostrated by a storm. In order to reëstablish communication under such circumstances, it has occasionally been necessary to connect a wire running from New York to Washington with one extending from the latter point to Atlanta, thence to New Orleans, from that city to St. Louis, and so on to Chicago. Such a circuit approximates 3,000 miles in length, and only an operator of exceptional powers of endurance has ever been able to send messages so great a distance in a satisfactory manner. As may be imagined, the sustained tension involves a severe nervous strain, to which some of the most expert short-line operators have been unequal.

If it is not convenient for a young woman to take a course in some institution where telegraphy is taught, she should enlist the services of the operator at her home office, as an instructor. After she has become familiar with the Morse alphabet, the manner of making, with the key, the dots and dashes representing the various characters, she must learn how to distinguish the same characters when she hears the sounder ticking them from a key operated by some one else. It is much more difficult for a beginner to learn to receive than to send, and nothing but practice will bring proficiency in either.

While it is not necessary for a telegrapher to be an electrician, she should study those fundamental principles that are applied to telegraphy. She should learn why the closing and opening of the key, by which the sounds are produced, charges the wire with electricity, and discharges the current from it, with each alternate movement. She should become familiar with the reason why the wet limb of a tree coming in contact with a wire will cause the current to escape from the wire to the tree, and thence to the ground, or why, when one wire crosses, or comes in contact with, another, the utility of both is destroyed until the contact is removed. Then, too, she should know the constituent elements of a chemical battery, especially if she expects to find employment in a country office.

The question of practice is the most difficult one to be met by the beginner who studies at home. There are automatic instruments and others, for beginners, but in the absence of some one with whom to

practise, they are generally of little utility. The better way is to obtain the permission of some local manager, to enter his office as a student, agreeing to perform some minor service, such as making out the daily and monthly reports, in consideration of the opportunity for practice. In this way the beginner will gain actual experience while acquiring proficiency.

In former years, the students sent out as graduates from telegraphic institutions were not held in high favor by managers, but their services are more in demand since it has been found that only experience in actual work is required, to make them the equals of the self-educated operator.

While the young woman is acquiring proficiency as a telegrapher, she should keep pace with her progress in that direction by practising on the typewriter, the use of that instrument having become an essential feature of the work. The managers of large offices will not employ an operator who cannot transcribe the messages as they come over the wire. It is much easier to learn to transcribe messages on the typewriter at the same time that ability to read the characters is being acquired, than it is afterward. In the latter case, the movement of the fingers over the keyboard takes the attention from the sounder, while, if learned together, the copying and the receiving of the message seem to occur as the result of the same brain impulse.

If a young woman seeks employment as a telegrapher merely incidental to the carrying out of some project, or as preliminary to the pursuit of a more lucrative vocation, it will be hardly necessary for her to gain a technical knowledge of the various branches. If, however, she expects to continue the work, and wishes to become as expert as possible, she should perfect herself in the use of the "code," a kind of shorthand method by which dispatches are now sent and received. The code is a system of scientific abbreviations of words, and combinations of letters, and by its use, expert operators have been able to attain a speed of eighty, or even one hundred, words a minute. The student, however, who can work at a speed of twenty to thirty words a minute will soon be able to find employment. The latter speed, indeed, if maintained for any length of time, would entitle her to consideration as giving promise of becoming an expert operator.

There is a fascination about the sending, and the receiving, of messages that is felt by all telegraphers, and especially by women. Even to those who have been in the service many years, there is more or less of the mystic in being able to hold converse with others who may be hundreds of miles away. Every operator gives some

distinguishing characteristics to his method of transmission, and, with her keen perception, a woman soon learns to recognize the touch of each of her fellow workers. This is done involuntarily, and is as natural as noting the difference in the sound of the voice, or in the style of the chirography, of various persons. Managers explain the lower wages paid to telegraphers at the present time by stating that the supply of labor exceeds the demand; in other words, that there are more operators than there are wires. This excess involves perpetual competition for employment which, while it may raise the standard of efficiency, has a tendency to lower the scale of wages.

Male operators are, as a rule, better paid than women, even in cases where the latter are equally efficient, and perform as much service. This is generally due to the fact that the men have families to support, while the younger women, at least, have the protection of homes, and are often willing to work more cheaply on that account. In country offices, or in small towns, the salary of a woman operator ranges from thirty to forty-five dollars a month. The average in the main office in a large city is much higher; a few receive only about forty dollars a month, but there are some whose pay is as much as eighty dollars. The latter, however, are chiefs or assistants. The average salary may be said to be about fifty dollars a month.

A few exceptionally expert women operators have found employment in brokers' offices, where the hours are short and the wages far above the average, and where the chief essentials are accuracy and speed. Most of the messages coming over the wire are in cipher or figure, and a single error might mean the loss of many thousands of dollars. As a rule these positions are filled by men, but the number of women occupying them is gradually increasing. The average pay for both men and women in this work is about twenty-five dollars a week.

# THE WRITING OF ADVERTISEMENTS

ONE of the newest fields open to women, and one in which they should find few obstacles to success, is the writing of advertisements, or « Ad. Writing » as it is briefly termed. As yet, however, few women have entered this domain of wage-earning, for the reason that they have had little opportunity to acquire knowledge concerning it, but, as most of the business colleges and correspondence schools have added the subject to their list of studies, it is not unlikely that women will ultimately earn good incomes, by assisting business men to call public attention in the most effective manner to their bargains.

The writing of advertisements became a separate and distinct vocation some twenty odd years ago, when one of the leading merchants of this country started a column of chatty discussions of the bargains he had to offer, in each of the daily newspapers in his city. For this work he employed one of the brightest editors of a leading journal. The text of the article was printed in large, clear type, and invariably began with the weather prediction for the day.

If rain prevailed, or was threatened, there would always be something in the first part of the article about the bargains in umbrellas, mackintoshes, rubber boots and shoes, and other seasonable materials. On bright days, the principal part of the discussion would be of such goods as were suited to the conditions. So attractively were the articles written, that many persons who had no intention of making purchases read them simply because they were interesting. It was not long before this pioneer in the field of advertisement writing was receiving a salary of ten thousand dollars a year.

Soon after this innovation was introduced, other merchants found it necessary to do something of a similar character, not only in order to increase their trade, but to hold that already gained. Then the originator of the idea increased his space to two columns, one of which was devoted to schedules of prices. An enterprising soap manufacturer made the next advance, by engaging an entire page of advertising space in each of the papers of his city, and filling the pages with cleverly written paragraphs describing the merits of his product.

All this proved so profitable to the advertisers, that men in all branches of business seemed to vie with each other in the extent and attractiveness of their advertisements. At the present time, full-page

advertisements are common. As the business men could not devote their own time to preparing these elaborate productions, and as their employees had no special training in that line, it became necessary to engage the services of persons of peculiar qualifications for the work. It has thus come to pass that a new school of writers has been developed within a comparatively recent period.

Success, however, with either men or women, whatever their preparation or experience may have been, depends in this, as in other vocations, on their being able to comprehend, and to meet, the requirements of the business.

To the end that women who may aspire to enter this field may understand some of its features, a description of the manner in which the advertising is managed in a great department store will be of value. The work is carried on by a regularly organized bureau, of which the chief advertisement writer is the head. Every day, each of the heads of the departments furnishes to the advertising bureau a list of bargains for the day following. These are classified by the chief writer, who decides in which of the newspapers the respective bargains shall be advertised. Articles that would be purchased only by people of wealth are not advertised, of course, in papers whose circulation is chiefly among those of humble circumstances, and the reverse of this observation is equally true. The preparation of so many different advertisements, therefore, requires a corps of assistants, whose work is under the direct supervision of the chief advertisement writer.

The chief, having a thorough understanding of the nature of the bargains offered, and knowing exactly those which the firm wishes to make most prominent, is able to instruct his assistants as to the article which should be "featured"; in other words, put in the largest type, and in the most striking positions. The chief himself, as a rule, writes the "reading matter" announcements which are at the head of each advertisement.

To enable the writer to "display" the various bargains with an appropriate kind of type, each newspaper furnishes him with a type schedule. The men in a composing-room know the different fonts of type by their technical names, and there are many hundreds of varieties. It is unnecessary for the writer of advertisements to commit these names to memory, since for his convenience the fonts are numbered. But some general knowledge of the different types is necessary.

The foregoing has reference only to the construction of advertisements for merchants and manufacturers. There is another class of advertisement writing that is much easier, but which requires some

special talent — that is, the «reading notices,» such as are used by many of the patent medicine firms. Everybody is familiar with that form of article which begins with the narrative of some thrilling adventure, and ends with a recommendation of somebody's sure cure for rheumatism, or other ailment. This is what is termed a «reading notice.»

Then there are the short, pithy paragraphs which, while apparently perpetrating a jest, or expressing an epigram, in reality commend some universal remedy for the ills to which human flesh is heir.

One of the most profitable forms of advertisement writing is that which is expressed in poetry, or rather in rhyme. A stanza of four lines having a certain jingle to it, is sometimes worth more to the writer than a column of reading matter would be. There are a number of firms who use this form very largely, and who offer liberal terms for acceptable productions.

Should a young woman desire to enter this field of advertisement writing, her best plan would be either to secure employment in some advertisement writer's bureau, or to take a course of instruction in a school of journalism. If neither of these resources is available, she might find it profitable to study the advertisements in the daily papers, with the assistance of a type schedule obtained from some printer, and then to try to construct a better advertisement than the one she sees.

There is one thing that aspirants for employment as writers of advertisements must observe first of all, and that is that while condensation is required in every branch of commercial writing, it is one of the most important of all considerations in the construction of advertisements. Advertising space in magazines and papers is paid for by the line, and it is evident, therefore, that as much as possible must be condensed into a given space, in order that the advertiser may realize the greatest benefit from his outlay.

# WOMEN AND ADVERTISING

## A CALLING WHICH AFFORDS OPPORTUNITY FOR TACT AND ARTISTIC TASTE, AND GIVES GOOD RESULTS

*By H. C. CANDEE*

Two women met on a crowded street corner.

"What are you doing now?" asked the prosperous one.

"Looking for a job," replied the other; and, although she laughed, discouragement was loading her heart.

"Why don't you try advertising? That's what I'm doing."


"I will if you will tell me how."

"Go directly to a magazine and beard the lion in his den. Tell the business manager you wish to solicit advertisements for his magazine, and do your best to impress him with your ability. If you persuade him against his will, he will say to himself: 'That is a bright woman; if she can persuade me, she can persuade others.'"

The woman looking for a "job" did as her friend suggested, and applied to the manager of a certain monthly magazine. She was given the names of two firms to visit, and, equipped with statistics as to the circulation of the magazine and its rates, she started on her errand. She returned with an order from both firms, which so pleased her employer that she was put on a salary of twelve dollars a week.

After a time, her employer remunerated her on a percentage instead of a fixed salary. This, of course, made her ambitious to earn as much as possible, and, by concentrating all her powers of argument and persuasion, she succeeded in earning $115 the first month. Sometimes, men were crusty and repellent, sometimes oversuave, and in various ways they tried to make bargains too favorable to themselves; but the agent soon learned how to stand her ground against the determination of some, and the shrewdness of others, preserving all the while a keen good nature, which was her best defense. She ultimately associated herself with a magazine which makes a specialty of advertisements, and is now earning $5,000 a year, more or less, according to the fluctuations of trade.

An Attractive Field for Women.— This is not a fictitious case, but is an exposition of what has actually been accomplished, and of what is open to women of reasonable intelligence and good manners. Advertising, as a field of occupation for women, offers many opportunities, but is not a business that may be entered by a woman of slow wit or indolent habit, for it throws her into contact with shrewd men of business who are intolerant of inferior capability. The business, in its several branches, is successfully carried on by girls and older women, and is one of the few in which there is opportunity for advancement, with satisfactory compensation. Most occupations for women without investment of capital, limit the salary to a few hundred dollars a year, but a clever advertising agent can make as much as five or six thousand.

The easiest way to begin is to attempt soliciting, on a percentage, for magazines, which pay from ten to fifty per cent., on advertisements secured. The most successful solicitors are those who are fertile in ideas, and can tempt patrons with novel suggestions as to the manner of wording or illustrating their advertisements. The work of the solicitor is interesting and active, and develops considerable assurance, but good health is a requisite, for the work, although not hard, is constant, and requires perpetual running about from one business house to another. Should she be amenable to flattery, there is danger from that source, which she must realize and avoid with stoicism.

No untrained woman would be able to step at once into a position of advertising agent for a large concern, but she must approach it by gradual preparation, first soliciting advertisements for periodicals and assisting in their composition. This will give her not only experience, but also a valuable acquaintance which, if she prove her ability, will lead to the desired advancement.

# PHOTOGRAPHY

A woman who has had even a partial training in the principles of art — drawing, composition, and color — possesses, already, the basis of success in photography. Formerly the chemistry of photography was a bugbear, involving unpleasant labor, and untidy hands. All that has been changed. The chemistry of modern photography is simple, clean, and fascinating.

The young woman who desires to study photography, with a view to future professional work, would do well to offer her services to a local photographer, agreeing with him to assume the drudgery of the studio in return for practical instruction. She will have little difficulty in making such an agreement. In a day she can learn to make, paste, trim, mount, and spot, prints; she can also be of service in the reception-room. By observation and practice she should be able to understand within a few days the developing of the negative, and the making of prints. Retouching will also be a part of her education that is easily learned.

It is in the operating-room that a woman has the fullest opportunity for displaying her qualifications for photographic work. Posing and lighting the subject call for a discriminating taste, and she must be quick to note facial defects, and to minimize them. She should possess also inexhaustible patience, and an affable, not a gushing, manner.

Assuming that she knows how to make a photograph that will please the patrons of the studio, the woman is ready to turn her knowledge and skill to the best account. She may be unable to open a studio of her own, and must, therefore, secure employment in a studio already established. Her compensation will vary from seven to twenty dollars a week, according to her value to the business.

If she is a good operator, she could command, in a large town, at least fifteen dollars a week. The operation of developing, retouching, printing, etc., is chiefly mechanical, but in the operating-room, a woman has an opportunity to become a specialist. Many large studios have woman operators who attend exclusively to the posing of women and children. A woman operator is generally more successful with small children than a man can hope to be.

It is easy to see, therefore, that a woman operator who has tact, address, and technical skill, may expect to be unusually successful with the camera. Photographers have found this to be the case, and

are employing women operators whenever they find them equal to the requirements of the place.

If a woman knows how to make photographs, and has any capital, she should consider the matter of opening a studio of her own. The investment need not be large. The lens and the camera are the most expensive items of her outfit. A reception-room, arranged with a woman's good taste, should be as attractive as she can afford to make it—pictures on the walls, some easy-chairs, a table, and a rug on the floor. A dressing-room, with a long mirror, and toilet accessories, is a necessary adjunct. Three hundred dollars will buy all that is absolutely necessary at the outset. If she has confidence in her skill, and in her business ability, the young woman starting out in business can easily borrow this sum. Satisfactory references as to her character, and her standing in the community, will induce a stock-house to furnish the photographic equipment, a chattel mortgage note being taken in payment.

No one should advise a woman to open a studio unless she is able to do the work of the operating-room herself. A woman who can put individuality into her work, so that her unsigned picture will be recognized as the product of her own studio and that of no other, can build up a successful business with a high class of patronage. She should not make the mistake of doing cheap work. It never pays. Fine cabinet photographs ought never to be made for less than five dollars a dozen—six or seven dollars is better. For a large head, on a plate 8 x 10 or 10 x 12 inches in size, the price should be from one to four dollars for each print; and for an original sitting, no order should be accepted that will return less than five dollars. Of course, the quality of the pictures delivered must justify these prices. Experience has shown that people will pay proportionately more for good work than they will for a cheaper article. Then there is a certain class of patrons who are suspicious of the quality of an article unless the price is high. Make fewer pictures, and get more money for them, is a safe motto with which to start; in the end you will have more business than you could attract by "bargain prices."

Several women in America have built up a successful business, and achieved no little fame, as photographers. Among them are Mrs. Gertrude Kasebier, of New York; Miss Mathilde Weil, of Philadelphia, and Miss Frances Benjamin Johnston, of Washington. About ten years ago Miss Johnston was engaged in "killing time." She had studied art a little; then some one gave her an amateur camera. She became interested in photography, and set out to master the art. She has a charming studio in the grounds of her home, far from the business part of the city, and here presidents, cabinet officers, diplo-

mats, poets, painters, and musicians, go to be photographed. Miss Johnston makes good pictures, and receives large prices for them. What she has done, other women can do as well. Patience, persistence, and judicious personal advertising, were factors in Miss Johnston's success.

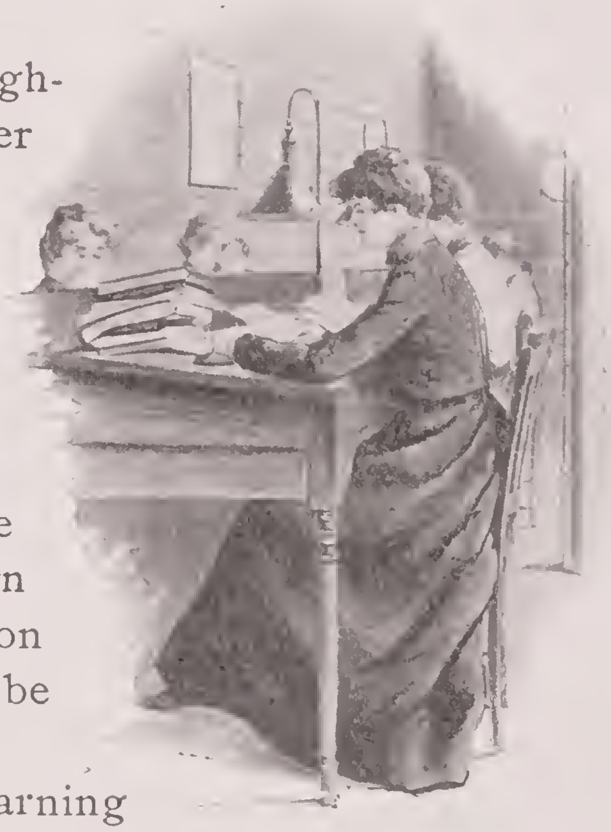
A woman who engages in photography for a livelihood, should not confine herself to work under the skylight. There is a large field for expert photographers in making pictures of people in their homes. Such portraits are usually better likenesses than those made in the studio, for the subject is at ease amid familiar surroundings. Children are more easily photographed at home.

It pays the photographer to make a series of well-selected views of beautiful, familiar, or historic spots about the town. Daintily printed and mounted, these are readily salable at holiday seasons, and to some extent, throughout the year.

In the line of photographic work there are many other avenues of revenue. The main thing is to give your pictures an individuality, and a tone that will advertise the maker as an artist. A business of this sort, in the hands of a capable woman, should yield a net income, yearly, of from one thousand to five thousand dollars, according to the population which may be expected to furnish patrons.

# PROOF-READING

Except in the smaller printing establishments where the service of but one person is needed, the ability of a woman proof-reader is rated on the same basis as that of a man. The preference for a man in the smaller places is attributable only to his willingness to lend a hand, when necessary, in the other work of the office. In general, however, the woman proof-readers earn, and receive, the same remuneration as do men of equal ability.



The salary paid to women proof-readers throughout the United States is usually from 25 to 40 per cent. higher than that received by their sisters in the composing-room.

The price for service demanded, and received, by all women proof-readers who are members of typographical unions, is 58 cents an hour. Men readers receive the same pay. Regular work at that price would mean $24.00 per week, and while there are doubtless many women proof-readers who earn and receive this amount, it would be an exaggeration to quote it as an average. Probably $14.00 would be nearer to the average weekly wage.

There are two sensible and practical ways of learning to read proof. One way is to acquire the rudiments of the work by serving an apprenticeship as a compositor, or typesetter, and the other way is to act for a few months as a "copyholder."

The former plan is considered by many successful women readers as much the better. The great majority of them began in that way, and the practical knowledge of printing thus gained has proved of great advantage to them in their work of proof-reading. One of the brightest of women readers admitted recently that she had learned printing as a typesetter in a small office in Missouri, where after four years of service as a compositor, she was placed in charge of the proof-reading department. Here she found that her knowledge of type and of typesetting had given her a wider knowledge of her work than that possessed by the readers under her.

The reader, or corrector, of printer's proof, is a necessity in all publishing establishments; this is owing to the fact that typesetting, whether done mechanically or by the old-fashioned method, is not infallible. Neither is the writer of the article. In other words, about

every article put into type for newspaper, book, or pamphlet, purposes, or even for small job work, requires revision. It is never accurate as it first comes from the hands of the printers.

From the publisher's standpoint, it is a disgrace to send out a newspaper bearing evidence of careless typesetting, that is with inverted letters, wrong type, or some other typographical error. It is much worse, however, for a publishing house to place upon the market an article of more lasting literature,—a book, for instance,—which is marred by such errors.

Many women proof-readers have had experience in both newspaper and book work, as well as in legal printing. A good education is a requisite to success in every branch of proof-reading. The woman with the best education, and the largest fund of general information, will secure the best-paying positions.

The beginner who starts out as a "copyholder," sometimes receives a small salary; sometimes no remuneration is given for six months.

## TYPESETTING

To the girl or woman who possesses a thorough grammar school education, who is quick of thought, and nimble of finger, there is yet a fair field in the work of setting type by hand.

So far as the work of printing the great daily papers of the country is concerned, typesetting by hand is practically a matter of the past. The linotype, a machine operated by one person, can *make type* from hot metal and "set it up" ready for the stereotype, as fast as four persons can set type by hand. Of course, there are yet many typesetters, or compositors as they are termed, employed on the greater daily papers, but their number is decreasing, and their work is mainly confined to the setting of advertisements.

However, with so many thousands of newspapers,—daily and weekly,—published throughout the country, many of which cannot afford to own the linotype, there must, necessarily, be a great demand for experts in hand composition.

To one who has spent several years in newspaper, and other, publishing plants, it seems that there is as much opportunity for a woman in the field of "hand printing" as there is in the line of stenography. An ordinarily bright girl should learn in six months

to set type fast enough to earn from $4 to $6 per week, and at the end of another year, to make her services worth from $8 to $12 a week.

A girl or woman desirous of learning typesetting will have no difficulty in finding an opening. In almost every town and city in the country there are publishing establishments of some kind. An application for an opportunity to learn, made to the publisher or foreman of a printing house, will probably bring the desired result.

No young woman, however, will really enjoy her experience as an apprentice. Nevertheless she could not acquire in any other way so much useful rudimentary knowledge in connection with her chosen work.

In the offices of many of the smaller daily papers throughout the United States, young women compositors have acquired a knowledge of newspaper work which has proved of much service to them. Some have become reporters, and in a number of instances, have risen to editorial positions. In one city of 100,000 population, the city editors of two papers, one a leading morning journal, the other an afternoon paper, are young women who have graduated from the typesetting case. If the novice in the work of typesetting can choose the establishment in which to begin her labors, it is advisable for her to select a newspaper office.

On entering a composing-room for the first day's work, she will probably be introduced to an experienced compositor of her own sex, and a case will be given to her from which to learn. Her instructor will then explain to her the difference in the appearance of a few kinds of type in use in the office. Later on, she learns how to "distribute" the type, that she has set up so laboriously, piece by piece, in the "stick" which she has held in her left hand.

In the thousands of job printing offices, there are almost always positions open for good compositors, male or female. These places are not always permanent, but they are more likely, for several reasons, to offer permanent work to the woman printer than to the man.

# PIANO-TUNING

Piano-tuning is one of the most remunerative occupations for women. At the present time, it is also one of the least crowded, for it was only a comparatively few years ago that women first took up this line of work with the practical purpose of making it a means of self-support. At least, this is true in our own country. Abroad,

especially in England, a large number of women are employed as piano tuners, and the work is regarded there as coming quite as much within the capacity of women as of men.

A piano player is inclined to regard the tuning of the instrument as a merely mechanical art, requiring very little musical skill on the part of the tuner. It is true that the training necessary to make a good performer is not at all necessary for one who wishes to become a tuner, yet the one who tunes the piano must have quite as accurate an ear for harmony, and as true a perception of concord as has the player himself. Without a good ear, it would be useless to attempt the work.

Piano-tuning may be learned at school, of a private instructor, or from books. Only a few American music schools, however, have opened classes in tuning, but to these classes women are admitted on the same footing as are men, and receive the same instruction. Much of the work done in the school is the tuning of the piano in actual use by the students, and in this way the most valuable practice is assured. It is said that in some manufactories, a tuner from a good school is preferred to one trained at the works, for the reason that the practice on old pianos is considered better training than that gained in tuning new instruments.

While a course at a school is an advantage both in learning, and in securing work afterward, it is not always attainable, owing to the distance of such a school from one's home, and possibly because of the larger expense involved. The next best method would be to take private lessons with a practical tuner. In this way, a woman can gain a good working knowledge of tuning, and, with close application, can fit herself in a short time to undertake work on her own account. To attempt to learn the art from the printed manuals pretending to teach

it, would be the most difficult method of all, and of little practical value.

The objection of lack of physical strength has been urged against women in this line of work. Good health is, of course, as much to be desired in this as in other occupations, but no more muscular or nervous strength is needed for piano-tuning than for typewriting, dressmaking, or school-teaching. Women are also said to lack the mechanical ingenuity necessary for such work, but for many years they have proved themselves skilful workers with machinery in factories and in shops, where fully as much ingenuity is required. This opposition is no more than that met by women in entering any new occupation.

After preparation, a good piano-tuner is reasonably sure of constant employment. When the steady increase in the sale of musical instruments is considered, it is clear that the demand for this class of work will be virtually unlimited. A position with a piano house would be a most favorable opening, as it would insure a regular salary. If such a place could not be secured, a woman could build up a business for herself. Judicious advertising would bring good results. Business cards left with friends, and at the music stores where she is known, would help a woman to make a beginning. Prompt attention to orders, courtesy, and careful work, would secure permanent customers who would pay well for good service.

Perhaps the best outlook at the present time is in the small towns throughout the country, or even in country homes, where it is difficult to obtain the services of a good tuner at any price. A woman willing to travel through these smaller places, visiting each at certain times, would, without doubt, find more work at good prices than she could possibly attend to, and her income would be limited only by her ability to accomplish all of the work secured.

# LIBRARIANS

Among the vocations which are open to women is that of employment in public libraries, as librarian, or assistant thereto. The value of good literature is more and more recognized, and freedom of access to it by the multitude who cannot, or do not, buy books, is a potent factor in the betterment of mankind. Already a free public library is deemed one of the essentials in every town. Public sentiment demands libraries, and gives abundant evidence of its willingness to sustain them. We are justified in the presumption that there will be a constantly increasing need of persons who are skilled in their management.

In the light of experience, it may fairly be said that a woman, when suitably equipped by taste, education, and training, is in the largest measure adapted to manage a library, and to serve its patrons satisfactorily. A "bookish" atmosphere is congenial to her. Its refining influence is felt by all who are brought within it. A love of order is inherent in woman, to a greater degree than in man, and in the library she finds abundant opportunity for its exercise. It is not easy to imagine a place where disorder and lack of system are more fatal to success.

Not all women would make good librarians; no more would all men. This, like many other vocations, requires a certain fitness by nature and training. There are few, however, who may not prepare themselves for a proper discharge of its duties. A woman possessed of average intelligence, and tact, with the natural graces of heart, mind, and manner, that are characteristic of the sex, needs but to add thereto a fair knowledge of books and authors, and of the technical duties of the position. It is by no means necessary that she should know it all at the start, but she must possess some information along the indicated line. With her daily work, this knowledge will increase with surprising rapidity. Upon her ability to answer the many questions that will be asked, to connect books with their authors, and authors with their books, and to generally familiarize herself with her work, will largely depend her success.

In the libraries of the country, taken as a whole, many more women than men are employed. It has been found that, other things being equal, they are better suited to such positions. It is no doubt

true that men will continue to be at the head of the great libraries, but for the subordinate stations, and to manage the smaller libraries, the call is for women. In the lesser cities, and the towns, by far the greater number of libraries are managed, and most successfully, entirely by women. They also have charge of many of the libraries at our institutions of learning.

In most places, libraries are established, and conducted, upon a scale corresponding to the size and resources of the cities or towns in which they are situated. Often they are begun in a small way, and grow, as means for their support are provided. In such cases, one librarian is sufficient; and for this grade of libraries, women are employed almost exclusively. With the growth of a library, and its patronage, there is a proportionate increase of labor, and compensation. One trained person can do the work for a library of from 5,000 to 8,000 volumes, but when the numbers are increased to 10,000, more assistance is needed, at least during the hours when the demand for books is greatest.

Well established libraries are usually open to the public from eight to ten hours during each week-day; the smaller ones, from four to six hours. For those having a steady patronage, the time is divided between forenoon, afternoon, and evening,— two or three hours each. The custom of opening the library in the evening is almost universal. It is an obvious necessity, for the accommodation of the large number of people in every town who are employed during the day, and who would, otherwise, be deprived of its use. Evening service of this kind must interfere, to a large extent, with the social pleasures and duties of the librarian — a point that should be duly considered by the young woman contemplating such work.

There is a growing demand that libraries should be open to their patrons during certain hours on Sunday. There is much discussion of the matter in the press, in the pulpit, on the platform, and in municipal legislative bodies. A few libraries have already yielded to the public desire, and the experiment is watched with interest. Both sides of the question present a field for argument, but there are strong indications that the "ayes" will increase, until the opening of libraries on Sunday will be a common and popular custom.

In every well-appointed library there is a reading-room for the convenience of patrons, and especially for those who wish to consult books of reference. Such volumes are not for circulation, and may not be taken from the building. Cyclopedias, lexicons, biographical and other dictionaries, books of quotations, atlases, and other volumes of similar character, are invaluable to those in quest of specific information. A good collection of reference works is an important feature

of a library. For use in the reading-room, there are also such magazines and other periodical literature as may be provided. The librarian should exercise a careful supervision of the reading-room, and enforce a strict observance of all rules regarding order. Thoughtless young persons are too apt to make it a place for visiting, and social gossip; and if unchecked, they seriously disturb and annoy others who are there for reading or study. In all of these matters, the librarian must, of course, set the example. The proprieties indispensable to such a place must not be overlooked or forgotten. The first duty of a librarian is to keep everything in the best possible order. This cannot be too strongly impressed. Every book has its place, designated upon its label, and must be kept there. A volume out of its place is lost. All books returned by patrons should, at the earliest moment, be put where they belong. If this rule is strictly observed, a book that is called for may be quickly found, unless it has been drawn, and not returned. Scarcely less in importance, the librarian must keep, in books provided for the purpose, a careful and correct record of the drawing and the returning of all books. A rule requiring that a book shall not be kept beyond a certain time, usually two weeks, must be carefully observed, to prevent loss. Many persons who draw books are careless of their return, and it is the custom to impose a small fine, or penalty, for the retention of books beyond the limit. It is customary to notify the laggards, by mail, or otherwise, and to do this is part of the work of the librarian. With a good system, all this is easy; without system, it is impossible.

How shall a woman prepare herself to fill acceptably the position of librarian? A young woman who reads, and who keeps fairly abreast of current literature, upon reaching maturity is already well started. If she has the vocation of librarian in view, she will take special pains to become informed, and to remember what she reads, and learns. She will find a trained memory an invaluable assistant. If she is favored by daily association with persons of literary culture, this will be to her advantage. She may thus acquire much by simple absorption, and really without effort. But when she has gained a knowledge of books, and of those who make them, she still needs to know something of the practical management of a growing library.

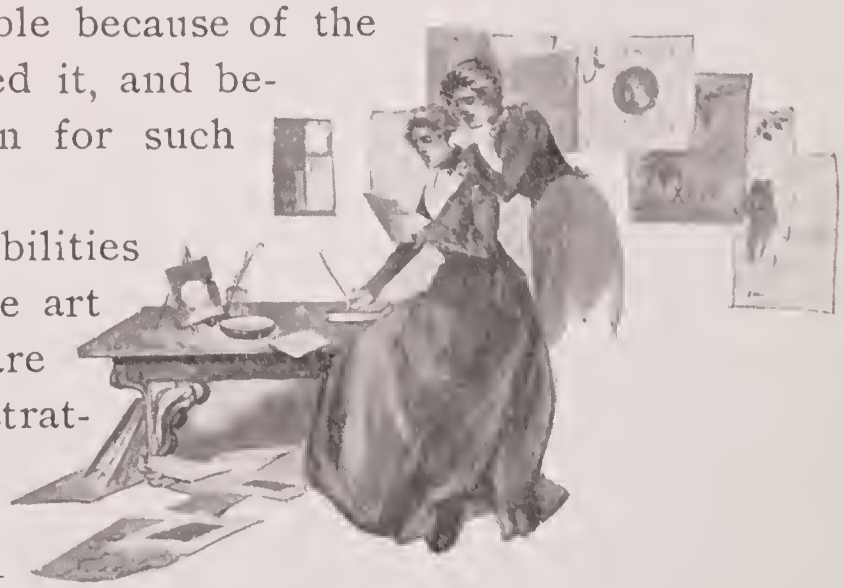
In most of the business and technical schools, library work is recognized as a distinct vocation, for which preparation is necessary, and a course of special instruction, with reference thereto, is given. The principal features of this are: the proper classification of books under a score or more of different heads; the most approved system of cataloguing, with periodical additions by the purchase of new publications; a system of recording books drawn, and returned. All

these points are practical, and essential. Some learn more quickly and more thoroughly than others, but there are few who cannot master the art sufficiently to achieve success.

The compensation paid to women employed in libraries is generally in fair proportion to the service required. In many cases, where there is a peculiar aptitude for the work, with the added acquirements, the salaries are generous. The range is wide, between $30 and $125 per month. In a few cases, the latter figure is exceeded. Of course, very much larger sums, reaching $3,000 and even $5,000 per year, are paid to the men who are the executive heads of the great libraries of the country. These positions can be attained only through many years of service and study, and, as already said, are likely to be filled by men. But there is an ever-growing demand for women to conduct the smaller libraries, and to fill secondary positions in the larger ones. Salaries of from $40 to $75 per month are frequent, and constantly becoming more numerous.

## ILLUSTRATING

PUBLISHERS often comment upon the fact that comparatively few women have taken up as an occupation the work of illustrating books, magazines, and periodicals. The scarcity of women in this field is regarded as the more remarkable because of the success achieved by those who have entered it, and because of the liberality of the remuneration for such work.



There can be no question as to the capabilities of women for this vocation. Every year the art schools send out scores of students who are thoroughly competent to do superior illustrating work, and there are scores of others who have acquired proficiency under private instructors; yet the fact remains that what would seem to be one of the most congenial and most profitable of all the occupations for which women are best fitted by nature, is to a very large extent neglected by them.

It was a publisher who said, in discussing the subject, that women artists are inclined to permit their ambition to get the better of their judgment; that as soon as they leave the art school, or studio, they conceive the idea of doing something, at once, to astound the world.

In such reverence do they hold the divinity of their art, that they regard as sacrilege the mere suggestion that their heaven-sent gifts might be turned in the direction of keeping the wolf from the door. They wish to paint a great picture; yes, and sell it for a great price; but the money received in that way would be accepted as a tribute to art, a mere token of appreciation, and not by any means as compensation. All of this, however, may as truthfully be said of the young artist; and the attitude is far from being an unworthy one.

Some of the great publishing houses employ a corps of illustrators, but, as a rule, most of the illustrating work is done "on the outside," as it is called in publishers' parlance. Magazines, and other illustrated periodicals, offer the best field for the illustrator, and but few of these publications retain a special staff of artists. The work is given to the artist best qualified for its interpretation. Many publications solicit original work from artists, and for such work pay good prices. In sending a drawing to a magazine, or paper, care should be taken to ascertain, as far as possible, the nature of the work usually to be found in the publication in question. Do not send humorous drawings to a paper that publishes only serious matter; or an illustrated poem, or decorative page, to the magazine that never uses such matter. This may seem like superfluous advice, but every editor of an illustrated periodical will confirm the assertion that a large proportion of the matter sent to him is at total variance with the nature of his publication. Half an hour spent, now and then, in looking over the current magazines, in the nearest stationer's shop, will be of great value to the aspiring illustrator — giving her not only an idea of what other artists are doing, but enabling her to choose, more wisely, a market for her own work.

The time will come, no doubt, when women artists will distinguish themselves in the illustrating field, as they have in directions of less promise. At all events, the opportunities are many, and the rewards of success far beyond those of the average vocation for women. But success can come only through thorough training in drawing.

# DESIGNING BOOK COVERS

The designing of book covers has come to be recognized as a distinct branch of art. Publishers and booksellers, always having in view the practical side of their business, are fully cognizant of the value of the outward appearance of their volumes. It is a well-known fact that while many persons buy a book only for the sake of its contents, caring nothing about the cover, thousands of others will be attracted by a tastefully decorated binding. This applies especially to holiday books, of which a very large majority are purchased by women.

In former years, the designing of book covers was a branch of art wholly monopolized by men, and, as a matter of fact, the number of men still engaged in it, largely exceeds that of the women who have taken up the work. Although there are a few woman artists in the large cities who devote their talents exclusively to the designing of book covers, the number is not sufficiently large to justify the classification of this work as a distinct vocation. This is true, notwithstanding the fact that some of the largest publishing houses give permanent employment to one or more cover designers. Most of the establishments, however, keep a list of artists, and when a design is required, the work is assigned to that one who is believed to be best qualified to fill the order. Because of this arrangement, it frequently happens that some one artist will receive the orders of several houses, and the work is thus unevenly distributed.

There is no regular scale of remuneration for cover designing, its establishment being rendered impracticable by the number of considerations that affect the price paid for each piece of work. The character of the design, the extent to which it is elaborated, the merit of the completed product, and the standard of requirement fixed by each individual publisher, must vary greatly in different cases, and allowance could not be made for these variations on a set wage scale. While there are artists of both sexes regularly employed as cover designers, who earn from two thousand to five thousand dollars a year, there are many others who take up the work only as an incidental means of adding to their income, and who, of course, are paid for each design, according to the valuation placed upon it by the publisher.

Any woman possessed of artistic taste, and creative talent, together with a thorough technical training in drawing and color work, may find an opportunity to enter the field of cover designing. Having acquired in an art school the necessary technical knowledge, and being possessed of what she considers the required amount of skill, the aspirant should apply to a publisher for work. In seeking her first employment, she will usually be requested to submit a few specimens of her handiwork. If she should be so fortunate as to make a favorable impression with these, she will probably soon have an order assigned to her, and, having once made a beginning, her future success will depend largely on herself.

The designing of covers for magazines, and periodicals, is another branch of the work furnishing employment to many artists. Any one having a liking for cover designing, and acquiring skill in it, should not hesitate to submit designs to the various publishers. Originality of conception, and exceptional perfection of execution, will be recognized, and work of this character is always in demand.

# DESIGNERS OF WALL-PAPERS, TEXTILE FABRICS, AND SILVERWARE

A TALENT for designing, when trained for practical application, may become a highly desirable possession. The demand for new and novel designs is unfailing, and the prices paid for such work are usually high. The larger manufacturers, as a rule, retain a staff of designers in their own establishments, but they also buy largely from artists who work independently. In all designing, an ability to draw well, and the possession of a creative talent, are of first importance. It is not enough that you should be able to copy, or to adapt, other designs; you must be able to produce new ideas. In order to achieve the best results in designing, it is also advisable to know, to some extent, the processes by which the goods for which your designs are intended, are manufactured.

Competition is constantly becoming keener. Art institutions are turning out skilled artists every year, and, in consequence, manufacturers are becoming more critical and exacting than they were ten years ago.

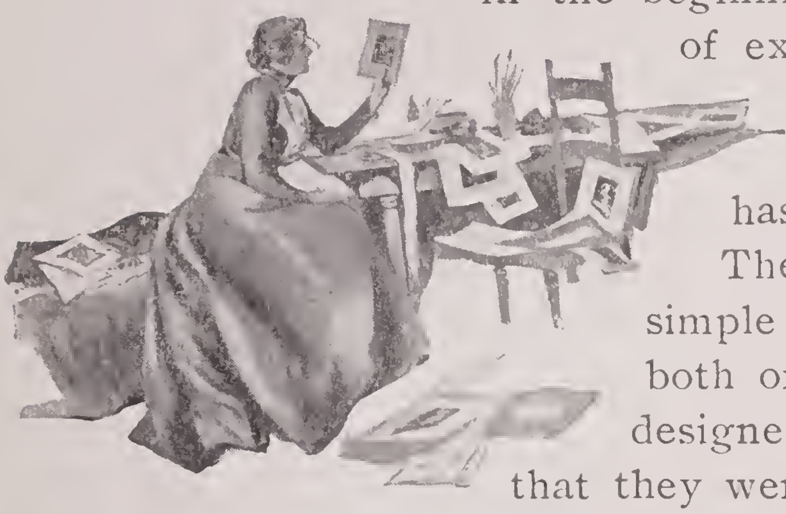
It would be well, however, to think seriously before deciding to devote your time and your money to the study of designing. The work calls for peculiar talent and ability, and pays only when you have become a skilled artist. In other words, in the field of designing there is small opportunity for mediocre talent and acquirements.

There are many branches of designing from which to choose. Besides the wall-paper, silverware, and silk manufacture, there is a constant demand for the best designs among publishers who want new book-covers; printers who must have new designs for "tailpieces," and quaint letters; even the maker of stoves must have novelties. And to the list may be added the products of the porcelain, and china, maker; the furniture maker; the carpet-weaver; the oilcloth maker; indeed, many manufactured articles call for the work of the designer.

There are many woman designers who earn large salaries. And it may be added that the best positions are held by men or women who understand the mechanical side of the manufacture.

# DESIGNING AND PAINTING CHRISTMAS, NEW YEAR, AND EASTER CARDS

The individual who is responsible for the origin of the Christmas card idea, conferred, without realizing it, a blessing upon a very large number of women; so also did those other persons who extended the idea to include New Year, and Easter, cards. The designing, and painting, of these cards as a vocation was virtually due, in the beginning, to the adoption by society of the custom of exchanging such reminders during the holiday seasons. Unlike most fads, however, this one extended far beyond its original confines and has become an established custom.



The original Christmas card was an exceedingly simple affair. It was intended to serve two purposes, both of which were commendable. Primarily, it was designed as a means of reminding absent friends that they were not forgotten, at a time when tokens of remembrance are most dear. The second consideration was that it proved an inexpensive medium for the expression of good-will between persons who could not with propriety exchange more costly mementos. The cards serve these purposes still, but the original idea has been developed to an almost marvelous extent.

Many hundreds of women, by whom the work is done almost exclusively, find in the designing, and painting, of holiday cards a congenial and profitable occupation. It is an employment, moreover, that continues throughout the year, not being confined, as might be supposed, to the holiday season. When it is remembered that there are thousands of different designs among the holiday cards, some of which are very elaborate, it will be understood that the work of production must be carried on long in advance of the season for which the mementos are to be used.

Many professional artists devote their entire time to this employment, while others work at it fitfully; but the professionals by no means monopolize the field. As the holiday season draws near, and the demand for designs increases, there are scores of amateurs who devote their talents to the earning of pin-money in this way.

The variety of holiday cards is almost limitless, both as to design and expense. There are cheap printed cards that can be bought for

a few cents, and there are hand-painted ones, in oil or water-colors, that only the possessor of wealth can afford to buy. The demand for hand-painted cards has become one of the features of the holiday trade. It would be almost impossible, however, to meet this demand by supplying originals to each purchaser. It has been found necessary, therefore, when a design has been submitted that is likely to become popular, to employ a number of minor artists in the making of copies. These copies can be executed rapidly, and large numbers can be produced in this way. These are distributed among the stores in such a way as to give to the purchaser the impression that he is the possessor of an original. Many of the designs for the cheap printed cards, of which there is an enormous variety, are made by woman artists, scores of whom earn good incomes by this branch of the work. The more expensive of the hand-painted cards are cherished as souvenirs; they serve as ornaments, as well as a reminder of the sender. The price paid to the artist depends to a large extent upon herself. If the work is done for a dealer by whom she is regularly employed, the price may be fixed by agreement, but when it is done for an individual she may name her own price.

The number and variety of Christmas cards exceed those for either New Year or Easter, owing to the wider scope for original conception, and the more extensive demand. But some exceedingly elaborate and beautiful Easter cards have been produced, and the fact that they have found a ready sale is proof that it is worth the while of an artist who has no more profitable work in hand, to devote some of her time to such productions.

One of the attractions of this kind of work is that the artist can do it in her own home as well as in a studio. Then, too, the amount of her income depends largely upon her industry, assuming, of course, that her ability is such as to insure acceptable execution. The field is wide, and is an open one. The dealers care little, if anything, for the fame of the artist, except, of course, when some special work has been ordered, and are always ready to buy any specimen that recommends itself by its originality of conception and its perfection of execution.

# MINIATURE PAINTERS

During the past ten years, the art of miniature painting has been extensively revived, and a few women are deriving large incomes, and no little fame, from their work in this direction. It is needless to say that in order to achieve success in any large measure, a miniature painter must have a thorough art training. For the painting of a really good miniature, a high degree of technical skill and artistic judgment is indispensable. As a rule, not less than one hundred dollars is paid for a miniature, while the finest of this work usually commands much greater prices.

There is one method of miniature painting, which if less artistic in its results, is not wholly devoid of merit, and which enables one to secure a miniature at a comparatively low price. For this work the aid of photography is required. Instead of original drawing on the ivory, a faintly printed photographic image is produced, on the ivory or porcelain, and this in itself constitutes the preliminary work of "drawing." The colors are then applied and the completed miniature is mounted in a gold frame, or in a brooch. As some of these miniatures are no larger than a silver dime, the colorist must have an exceptionally delicate touch, and the use of the magnifying glass is indispensable.

Orders for work of this kind are usually taken by photographers and jewelers, to whom an ordinary photograph is furnished, with information as to the color of eyes, hair, and complexion. The work is sometimes given out by the photographer direct to the artist, but as a rule it is intrusted to firms that make a specialty of photographic reproduction. Young women do nearly all of the work of this character for such firms, and one of the largest of these concerns pays its miniature artists from seven to twelve dollars a week, according to the skill and rapidity with which they produce the work.

# CRAYON PORTRAITURE

In making crayon portraits, two entirely different methods are used. One is that of free-hand drawing, which is the more difficult, as it is the unaided work of the artist; the other is simply the finishing with crayon of an outline portrait made by photographic enlargement,—a method which, it may easily be seen, demands far less artistic talent than does the other. In the former method, the work is usually done on a warm-toned, English crayon-paper, the uneven texture of which helps the artist to produce a portrait that is lifelike in its expression, and possessed of a soft, delicate transparency in its shadows. This last is more especially true in a drawing from life, as here the artist is at liberty to arrange the light according to his own ideas of the requirements of his subject.

The other method of producing portraits in crayon is by finishing photographic enlargements. These were formerly made with the aid of the sun, and were called Solar prints; they are now made exclusively by powerful electric light. When a cabinet photograph is thus enlarged, the finest retouching on it becomes coarse, and the work of the artist, or finisher, is to make the portrait «smooth»—that is, to reproduce all that has been lost by the process of photographic enlargement. This process of enlargement is used also in producing water-color, India ink, and pastel portraits, and is the means by which the vast majority of the good, bad or indifferent portraits are now produced.

The artists who make portraits in crayon may be divided into three classes. The first of these make a specialty of free-hand work only, and refuse to recognize in their pursuit any element of a purely business nature. Each artist has his individual sitters, and even if he were so inclined, he could not work for the photographers, as the latter encourage their patrons to have portraits made by photographic enlargement. This is a subject on which the artist and the photographer never could agree, owing to the difference of opinion held by each as to the merits of the respective methods. The prices paid for free-hand portraits vary greatly, but a general estimate may be

formed from the fact that there are many woman artists in our large cities who receive prices ranging from twenty-five dollars to one hundred dollars each, for crayon heads.

The second class of crayon artists is composed of those who finish photographic enlargements for photographers, agents, and the trade generally. This is plainly a good grade of work, since it is used by all leading photographers, many of whom prefer, for certain reasons, to have it done by women. As the artists are paid in proportion to the amount of work done, and not according to the time occupied, it may readily be seen that rapid work is not a necessity. Prices for finishing depend largely on size, and upon the grade of the work, and range from five dollars to twenty dollars for each piece.

The third class comprises those artists who are employed in the copying houses, of which many are to be found in our large cities. These establishments receive their orders through agents who canvass in adjacent towns and suburbs. The majority of the finishers employed are women, and they receive the same compensation as do the men.

The work is divided into four or five grades of finished enlargements, there being little or no free-hand work furnished by these houses. Nearly all the portraits are finished with a machine called an "air-brush," which is an air pump operated by foot-power, and fitted with a spray attachment. A solution of alcohol and lampblack is sprayed against the photographic enlargement, and in the hands of a skilful operator the air-brush produces a smooth, soft, effective portrait.

In the lower grades of work,—as might be supposed,—the remuneration depends upon the quantity of work, rather than upon its quality. The operators earn from six to eighteen dollars a week, though the average is nearer six dollars than eighteen.

Within the past ten years the field of crayon portraiture has suffered greatly through the sale, by unscrupulous persons, of so-called crayon portraits. By their misrepresentations, these people have succeeded in substituting for crayon work the cheap photographic enlargements. The latter are absolutely worthless — not only do they lack in merit, but they are so manufactured that, through the action of the light, the print must shortly fade from the paper. People are now beginning to put a correct valuation upon this class of work, however, and the demand for genuine crayon portraits is being correspondingly increased.

# CHINA-PAINTING

THE largest field for the painter on china is in the great cities of the East, and in certain of the Western cities, notably Chicago and Denver. The average skilled woman can earn from $20 to $30 a week by teaching, and from the sale of her work. In New York City, where the price of good lessons in this branch of art is high, there are several women earning much greater incomes.

The experienced painter on china will advise a beginner in the work to take a thorough course of instruction, with the best teacher to be secured. The cost of such a course, covering instruction and materials, need not exceed $150. But the matter of expense will depend upon various circumstances. After the first twelve months of study, the clever pupil should be able to earn something by means of her handiwork.

But no woman should take up the study of painting on china with a view to self-support, unless she feels convinced that her talent lies decidedly in this direction. The field is one that offers small reward to mediocrity. On the other hand, she who possesses talent and originality, and who has acquired the technical skill required for the best expression of her ideas, cannot but meet with success.

The new pupil who understands the rudiments of drawing, receives whatever further instruction in this direction may be necessary, and afterward learns the use of the colors and the details of the process of «burning» or «firing» the china — the method by which the design is made permanent.

The most satisfactory outlook for the future of china-painting, as a means of employment, is that which shows the increasing appreciation of the home-product, to the exclusion of the foreign importations. In the past, foreign goods have been much favored. The cost of a skilled decorator's labor was so low in Asiatic countries, and the import duty so light, comparatively, that competition in sale of similar goods, decorated in modern American style by home artists, was fruitless. The novelty of goods from the countries mentioned is fast disappearing, however, and to-day the originality and beauty in the best of the home productions is very generally recognized.

# THE TRAVELING SALESWOMAN

WHAT is known in the commercial world as a "drummer" is the man or woman who travels from place to place, selling goods for the wholesale establishments to the retailer. The work is arduous, but the income to be derived from it may be brought to a high figure by a capable salesman. Women have only within recent years undertaken to earn a livelihood in this field, for, owing to the constant traveling involved, and because the work seems in other ways to call especially for the services of men, it has been left almost entirely in their hands. Gradually, however, women have entered the field, and to the surprise of the merchants, they have proved most efficient drummers, not only in the lines of fancy goods, but for almost every commodity on the market.

Selling goods to the retailers is much the same the world over, and experience in this field is the best of teachers. The work demands peculiar qualifications for its successful conduct; but it is a field which few people enter unless prompted by these very qualities. In other words, it is an employment offering little attraction to those not fitted to meet its demands. Its difficulties are too apparent; indeed, they are likely to assume exaggerated proportions in the eyes of the inexperienced young man or woman looking about for a start in business.

# BUYERS FOR DEPARTMENT STORES

EVERY large store in the country employs several women in the capacity of buyers. It is the duty of a buyer to select the stock for one, or for several, of the departments in the house she represents. This work involves traveling abroad, or to the manufacturing places in her own country. The position is a responsible one, and one that commands a good salary. The higher-salaried buyers are mainly connected with the great department houses of the large cities. Of course, the expense of travel is borne by the firm.

In the less pretentious houses, the woman buyer is generally in charge of two or more departments, and when not traveling, daily superintends the selling of goods in these departments. As in other lines of employment, the best way for a woman to secure a knowledge of buying is to spend some time behind the counter. The successful woman buyer has almost invariably commenced in this way, and has thus gained much valuable information regarding the goods sold, not only in her own department but throughout the store. The kind of goods that sold quickest, and the proportionate demand for every article, became of special interest to her. Showing an aptitude for detail beyond that possessed by other saleswomen, it was only natural that her employer should one day place her in charge of a special department; and, as head of this department, she became also the buyer for it.

Securing a position as buyer, without first learning to sell goods behind the counter, is practically impossible, unless the applicant is especially recommended from the counting-room.

A woman buyer going to New York in the interest of her firm, must visit a number of wholesale houses, for the purpose of examining recent importations and native manufactures. She must know, when informed as to the price of certain goods, whether they can be sold by her employers at a profitable figure.

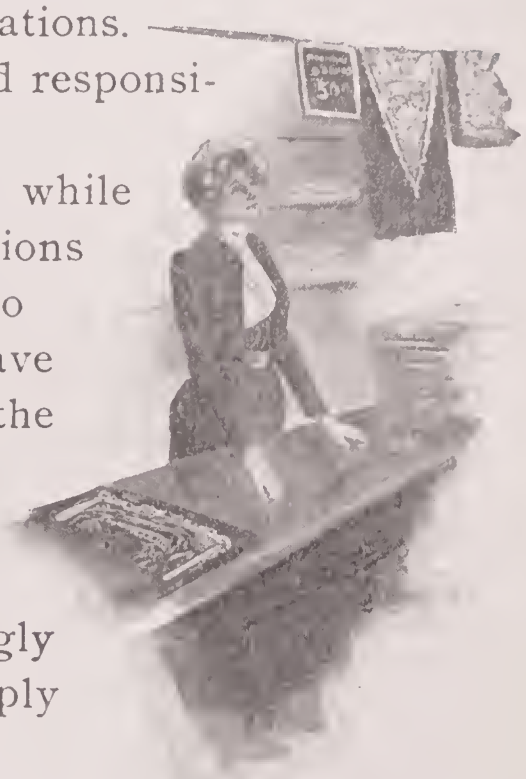
It is the buyer that makes or breaks the department store. Commercial acumen, therefore, is all-important. Her position is to be at-

tained only by long years of experience. The employee who works for the interest of her employer, and not merely for the money she earns, is the one who eventually gets to the top, for buyers command large salaries.

The first thing to be considered by the buyer is the class of people whose patronage is solicited. Goods must be either the best, or of medium grade, or the cheapest. She must have judgment of what the public will like, and knowledge of human nature to estimate how well people will like it, and for how long a time it will be popular. She must know the market, and keep her eyes open to the stock after it is bought. She must see that no other store undersells hers. She must see that stock is not allowed to accumulate, and that it is not permitted to get shopworn. She must see that attention is attracted to it, that the advertiser does it justice, that too much help is not employed in her department, and that the salesman pushes his goods sufficiently. She must watch a thousand different things, for the cash account tells the story. There is no going back of the figures. If these show losses to the firm, the firm holds the buyer responsible, This last is the situation in a nutshell. The successful buyer is, therefore, a person with an eagle eye and an alert sense, so that nothing escapes her. She must continually guard against the day of reckoning.

# SHOP CLERKS

THE female employees in one of the great modern department stores range from the cash girl, who receives two or three dollars a week, to the buyer for the firm, whose salary, in some instances, reaches several thousand dollars a year. The cash girl may never rise to the position of buyer, but there is no reason why she should not, if she possesses, or can acquire, the necessary qualifications. At any rate, she will not lose by it if she fixes that high and responsible position as the goal of her ambition.



Some of the expert buyers for the great establishments, while they have not begun as cash girls, have risen from positions as clerks. As a rule, the cash girls begin their work at so early an age that it is impossible that they should have been able to acquire the education which is requisite in the higher positions. This knowledge could, of course, be acquired by attending night schools, but the average cash girl, or shop clerk, is either too weary at the end of the day's labor to be capable of further effort, or is too strongly inclined to spend her evenings in recreation, to care to apply herself to study.

When the cash girl has proved by her punctuality, and by the exercise of keen wit, alertness, energy, and fidelity, that she is worthy of advancement, she is promoted to the work of wrapping parcels, for which she receives slightly increased wages. Her next step upward is to a clerk's place behind the counter, where her pay will be five or six dollars a week. In the course of time this may be increased to as much as eight dollars. But not all of the clerks begin as cash girls. Some of them enter a store after leaving the grammar school, being impelled to do so by a desire to earn an independent livelihood; or, more often, because of a necessity for doing something toward the family support. There are few, indeed, who seek such employment with the fixed object of making it a serious lifework. The work of a cash girl, or saleswoman, is little less than drudgery, at best, and the remuneration is small. It is doubtful if the average earnings of the girls employed behind the counters of the largest stores will exceed six dollars a week. There are, of course, some who are better paid, but it is only those who have attracted the attention of their employers by the manner in which they make

sales, by their courteous treatment of customers, and by their mastery of the details of the business in their respective departments.

If a girl goes into a store with the serious intention of making her services of value to her employers, she will find that there are opportunities for advancement. After some years of close attention to business, she may be placed in charge of one of the departments, with the details of which she is familiar. In a position of that kind, she will no longer receive wages,—her compensation will have acquired the dignity of being called a salary. This will range from fifteen to thirty dollars a week, according to length of service, special fitness, and the extent of her employer's appreciation.

The next step upward will be to a position known as "head of stock," where the salary will be from fifteen hundred to twenty-five hundred dollars a year. She will now have practical charge of the goods in two or more departments. She must know, to the smallest item, just what materials are on hand, must be able to select those which are suitable to be sent to the bargain counters, and must know just what may be needed to keep the stock up to the standard. It is her duty to be able to report to her employer whether the sales show a certain line of goods to be popular with the public, or whether they are likely to remain on the shelves until they become shopworn.

It is her experience as head of stock that qualifies her for the best-paid position in the employ of the firm, that of buyer. If she is fortunate enough to gain this promotion, she may receive anywhere from twenty-five hundred to ten thousand dollars a year. There are young women who have begun their experience as buyers at the minimum salary in one establishment, and have been offered the maximum for their services by a rival house.

The woman who holds one of these positions must know as much about the business as does her employer, and sometimes more. She must be able to look far into the future, and must possess unerring foresight and judgment, as to the fabrics and fashions that will become popular. She will probably have to make two or more trips to Europe every year, and her purchases for the firm will often amount to tens of thousands of dollars. An error of judgment on her part, would mean a serious loss to her employer, and perhaps the sacrifice of her own position. She must know values to such a nicety as to be able to figure closely as to the probable profits on any purchase. As she will have to deal with shrewd business men, she will need to exercise all her wit to avoid being imposed upon.

One of the most important features of the buyer's work when at the home establishment, is to keep watch of the stock, not only of all the departments for which she does the buying, but of that in cor-

responding departments in rival stores. If one store is marking down certain materials, the other must do the same thing in order to hold its trade.

There are buyers who have not risen from clerkships, but they are few in number. In some cases, young women of education and refinement, who have been thrown upon their own resources, have found it possible to utilize their good taste and their knowledge of what women like, to the advantage of the merchants, and to their own financial profit. Before their employment as buyers, they have had to go through preliminary training in the business details.

As has been said, while the wages paid to clerks are small, there is scope in the great store for the ambition of any girl who enters upon the work seriously, and with an earnest desire to succeed.

These observations apply mainly to the great department stores. In the smaller establishments, the wages are about the same, but the opportunities for advancement are fewer, since the employer is generally his own head of stock and buyer.

# WINDOW-DRESSERS

THE work of trimming show windows with samples of the goods for sale in the store, has become a distinct vocation. At the outset, the persons selected for this employment were men, exclusively. Most of them had had years of experience, behind the counters, perhaps, and were familiar with the materials which the merchant particularly desired should be attractively displayed. The first attempts at making these displays were unquestionably crude. This was due to the fact that the work was done by the busy salesmen, who were permitted to devote only a portion of their time to it. After a while, it became evident that the prime qualifications for success in arranging the window exhibits were taste and a certain regard for artistic effect. Then some merchant made the happy discovery that one of his saleswomen possessed these qualifications in a marked degree; and, gradually, it has become the custom to employ for this work, men and women who devote to it their entire time and attention.

While it is not essential that a woman who aspires to earn her living as a window-dresser should receive her training as a shop-girl, or clerk, nearly all of those who have entered upon the vocation have begun in some humble employment in a store, and have demonstrated their fitness for the work, as opportunities offered. There have been, however, a few notable exceptions.

As has been said, the prime qualifications for this work are good taste and an artistic sense of the harmonious arrangement of colors and fabrics. To these should be added ingenuity in producing new or novel effects. It would probably be well for any woman aspiring to such employment, even if she possesses the requisite qualifications, to gain a preliminary experience behind the counter of a store. She will in that way familiarize herself with the goods and their decorative possibilities, and will be able to invent combinations for display purposes that will be sure to please her employers.

# CONDUCTING A LAUNDRY

To establish a laundry, equipped with modern machinery, a capital of several hundred dollars is needed. After securing the necessary offices and machinery for the conduct of the work, every effort possible must be made to secure a large and desirable patronage. If the laundry is in a large city or town, advertising is best done through the medium of cards and neatly printed circulars, which should be sent by mail to the residents within the available districts In smaller towns, newspaper advertising may be profitable; also house to house canvassing. The proprietors of successful laundries frequently include among their expenses the hiring of agents who call in person upon the residents to solicit their patronage, and who establish agencies in small shops, where the clothes may be left for collection by the laundry wagons. This, of course, applies only to a business conducted upon an extensive scale, either in a large city, or in a town where suburban patronage may be expected.

Before entering the laundry field, it is essential that a very thorough knowledge of the details of the work be acquired — not that the proprietor will find it necessary to personally assist in the washing and ironing of clothes, but because she must be able to intelligently supervise the work from start to finish. The larger the amount of work undertaken, the greater the amount of detail involved.

A prime factor in the successful management of a laundry is unvarying promptness in the collection and in the delivery of clothes. If it is not possible to begin business with the improved machinery to turn out ordinary work rapidly, a sensible plan would be to cater for high-class hand-work.

# PLAIN AND FANCY SEWING

There was a time when plain sewing on underwear brought at least a fair return; but the manufacture of garments in factories, by machinery, has revolutionized the conditions attending the making of ordinary goods. In a factory where ladies' and children's underwear is produced, there is a machine which cuts a hundred thicknesses of cloth to a pattern at one stroke of the die. The putting together of the garments is done by girls who operate machines moved by steam power. They receive from fifty to ninety cents a day for their work. The garments thus made can be sold at comparatively low prices.

There are other kinds of work that involve more or less hand work. Manufacturers who produce goods of this character cut and assemble the pieces of garments, and send them out by the thousand, through the country districts, where the wives and daughters of farmers, and residents of the small towns and villages, do the sewing. The work is delivered to them, and taken from the door, completed, at stated intervals. The sewing is done at odd moments, or in the evening, and as the work is paid for in cash, it is eagerly sought for. Yet the women who do this work make only four or five cents an hour. A year's work may not net more than twenty or thirty dollars, but it is "clear gain" to the country woman, who values her time lightly, and who seldom sees "ready money" with which to buy the ribbons and knick-knacks that she desires as much as does her city sister.

Against such conditions as these, the woman who attempts to make a living from plain sewing alone must compete. She will probably have to work twelve hours a day in order to make five or six dollars a week. She must buy a machine; and a good one will cost her forty dollars, at least.

There is a ray of light for the needlewoman who can build up a line of patronage among people of means, those who are fastidious

about their wearing apparel, and who will not wear factory-made goods. One woman earns a fair living by making shirts for men. A bright woman can make a man's shirts exactly right,— exactly as he wants them,— and she will take more pains with them than does the professional manufacturer of shirts. A man will cheerfully recommend to his friends a woman who can do his sewing as he wants it done, and it is possible for him to solicit, and to obtain, privately, enough business to keep her busily occupied. In a household where the wife must earn a part of the money that goes to support the family, there is a fairly satisfactory field in this work. Of course it is not intended to imply that shirt-making is the only phase of the work that is profitable; there is much work to be had from women of large means. Many of the latter, being fastidious in the matter of their shirt-waists, rarely purchase these dainty articles of apparel "ready-made," but order them from the most skilful manufacturer or seamstress available. For the making of a really satisfactory shirt-waist, four or five dollars is considered a modest price.

Fancy sewing is a term that may be made to include many articles of luxury. Embroidery and other sorts of fancy work are now, to a certain degree, fashionable occupations, even among women of wealth, and the market for outside work is correspondingly smaller than it was. But there is occasionally an outfit of dainty baby-clothes to be made, the "baby-basket" to be fitted up with its satin linings, or an elaborate trousseau to be prepared, on which much fine work with the needle must be done. In a large city, a woman might make a speciality of this, and work of a kindred character, and receive a fair remuneration. She will need to have enterprise, and must not be afraid of soliciting work. It is well to place a high value on one's own product, and to solicit work as one conferring a favor on the person approached, rather than as one seeking a favor.

In the article on women's Exchanges, will be found a suggestion as to the sale of fancy needlework not made to order. To make, and to offer, such work for sale in the stores is not likely to result in satisfactory returns; a woman who brings needlework to sell is presumed to be desperately in need of ready money, and a ridiculously low price is offered for it, in the belief that between a pittance and nothing, the pittance will be chosen.

In general, no woman is advised to undertake either plain or fancy sewing as a sole means of livelihood, if there is any other occupation for which she has adaptability, and in which she can make a market for her labor.

# MILLINERY

In order to succeed in the millinery business, a woman should possess much natural taste, not only in the matter of color, but in the selecting and combining of fabrics. She must also be willing to begin at the foot of the ladder—to learn thoroughly every detail of the work — so that she may not only know how to make a hat herself, but be able, as the business becomes more extended, to direct her assistants and her apprentices.

Beginning at the foot of the ladder, usually means serving an apprenticeship in a first-class millinery establishment. At the start, it is probable that very low wages will be received, but as the apprentice acquires skill in one or more branches of the work, she receives better remuneration. Later on, when she has learned the business thoroughly, she may open an establishment of her own, or seek a position with some successful firm. An expert trimmer can command $25 a week in any large city, and there are numerous instances of women receiving $40 a week. It must be understood, however, that the receivers of such salaries have not only mastered the details of millinery work, but that they possess artistic taste.

In case one does not wish to serve an apprenticeship in learning the millinery business, it is possible to-day to take a course of training in a school devoted to such instruction. Here a series of lessons is given to pupils in large classes. The pupil in one of these millinery classes must furnish her own materials for practice. The course of instruction includes training in wiring, binding, facings of all kinds; the making of bows, rosettes, wire and buckram frames; the trimming of bonnets, and small hats, and the details of black silk, and crêpe, work.

There are schools in which a pupil is charged a certain amount for being taught whatever she may wish to know regarding the art of making and trimming hats. There is no limit as to the time of attendance. Materials are furnished gratis, and, if possible, positions are found for the graduates. Most schools will attempt to place their pupils where small salaries are paid at the start. Young women who are apt in learning the details of the work, often secure salaries of from $6 to $8 a week immediately after a six months' course of instruction. The majority of pupils will not be worth so much. Probably $4 a week will be paid to them at the start. What a woman earns afterward depends upon her own enterprise and ability. If especially fitted

for the vocation, it will not be many years before she is commanding \$25 a week. Twelve dollars would be average wages.

The millinery department of a large store offers desirable positions to expert workers. The seasons are short for most women makers of hats, but many assistants are kept in this department of the large stores during the entire year.

Another way to gain success as a milliner is to build up a home trade. A woman capable of turning out good work may, with the aid of two or three friends who will recommend her assistance to others, gradually build up a very desirable home patronage.

To the average graduate of a millinery school, it would be advantageous to work in some shop for a month or two without pay. Such experience will be invaluable to her, since, through it, she acquires a knowledge of details to be gained in no other way.

The woman building up a home trade, should, if it is possible, do the shopping for her customers. She will thus soon learn what they like, and can at the same time broaden her own ideas. By registering at all stores where she intends to shop, a discount of from 6 to 10 per cent. will be allowed to her.

Going out to work by the day is another way in which a milliner may earn money. From \$2 to \$4 per day is paid, according to a woman's ability. Many women prefer to purchase materials for the making of their hats, and to use up old materials. By having a practical milliner come to the house by the day, a larger number of hats can be made from the expenditure of a fixed sum than if ready-made hats are purchased. The hours for work in going out by the day are from 9 to 5.

Having taken up millinery as a means of self-support, no woman should become discouraged. With every new season, there are new things for even the most expert to learn, but perseverance will tell, and success will come.

# KEEPING A LODGING-HOUSE

In order to start a lodging-house business, a woman should possess sufficient money to meet the expense of completely furnishing the selected house, and to cover several months' rent. The business is peculiar to the cities and to the larger towns, and its success in individual cases, depends almost wholly upon a judicious selection of town and neighborhood. This matter of selection is governed by various circumstances, and should be very thoroughly considered, from every point of view, by the one who contemplates the establishment of a lodging-house. Advertising is of assistance in the effort to secure lodgers, but the woman is fortunate who can fill her house without resorting to the newspaper columns. This is frequently achieved through the recommendation of friends and acquaintances.

When dealing with strangers, great care should be exercised in the matter of references. Upon this point it is impossible to be too particular, for the presence of undesirable people in your house, even for a short time, will go far toward the undoing of your best efforts. It is customary, not only to furnish references as to the desirability of your house, but to exact references from strangers seeking quarters with you. The same good business methods that should characterize the conduct of other occupations must also be adopted, if you would succeed in the management of a lodging-house

# THE CARE OF THE HAIR

In many hair-dressing establishments, other features of a kindred nature are combined with the treatment of the hair — wig-making, for instance, the preparation of cosmetics, and the sale of toilet articles, or hair ornaments. It is not uncommon to find the business of massaging and manicuring combined with that of caring for the hair. In this country, these establishments employ women almost exclusively, training them thoroughly to shampoo, dry-brush, treat, and arrange, the hair. This work may be done either at the hair-dressing parlors or at the house of the customer, and it is usually so arranged as to be regulated, and paid for, by a series of tickets made to cover a course of treatment. The price varies from ten to fifteen dollars for a dozen tickets.

To a woman about to take up the care of the hair as an occupation, the first important question will be, How can I learn the art? There are two ways in which this may be accomplished. First, she may go to New York or to Paris, to take lessons in one of the classes established for instruction in such work. But as this would be practicable only in exceptional cases, the usual method of procedure is to serve an apprenticeship of several months' duration in some home establishment.

Most hair-dressers will tell you that a girl must have natural qualifications for the work if she expects to be successful. But, except in the arrangement of the hair, which, obviously requires taste and style for its successful accomplishment, there is no reason why the young woman of average intelligence should not become skilful in the work.

While it is necessary to understand the structure, and the growth, of the hair, the diseases of the scalp, and their treatment, it is only practice that brings the thorough skill and knowledge indispensable to the best achievement. Formerly, skill in the arrangement of the hair into an elaborate coiffure was all that was considered necessary in the art of hair-dressing; to-day, the changing of gray hair to its natural color, without the aid of dye, the restoration of hair to the prematurely bald, the cure of scalp diseases, and the transplanting of vital tissues, have brought the care of the hair within the domain of science. Special treatment of this class, however, is not included among the duties of the ordinary hair-dresser.

Many women have found it profitable, after acquiring the necessary knowledge and skill in this line of work, to avoid connection with the regular establishments, and to confine themselves to the formation of a class of customers or patrons of their own. These customers are visited at their homes, once or twice a week, or oftener if desired. Different customers will require different treatment, but ordinarily the work of the expert is simply the good care of the hair. Shampooing is done when necessary, brushing and massaging of the scalp, and the applying of a tonic when it is needed. The treatments last an hour, and the charges are from fifty cents to a dollar and a half for each visit. It is, however, only in the larger cities that the latter price can be commanded. It is scarcely possible for a hair-specialist who goes to the houses of her customers, to fill more than six or seven appointments in one day, unless she works in the evenings. Going to and from houses consumes time, and this should be considered in her charges. Slackness in her work, untidiness of dress or person, a too great volubility, are all faults especially to be avoided. A pleasant manner, gentle touch, and respectful demeanor, are greatly to be recommended. There is a certain magnetism that is often exerted by one who treats the hair, and the hour of her visit may be one of the most pleasant to the patroness. Naturally much depends upon the personality of the woman who undertakes so intimate an employment as hair-dressing, and she will find that conscientious work, and an agreeable manner, are the best qualifications it is possible to possess.

## CO-OPERATION WITH BUTCHERS AND GREENGROCERS

By co-operation with the butcher and the greengrocers of her neighborhood, an enterprising woman may, with good management, add very substantially to her income; and this without neglect of her household duties, or to the exclusion of another line of work. The greengrocers, carrying throughout the greater part of the year, large supplies of fresh fruit and vegetables, are unable, even with the best management, to avoid the losses that attend, to a greater or less degree, the handling of a perishable stock.

There are various circumstances that may interfere with the daily sale of such stock, and the proprietor of the shop frequently finds himself at night with a large supply of wilting vegetables or fruits on hand which will be wholly useless on the morrow. By arrangement

with one or more of these stores, the woman who understands thoroughly the art of preserving and pickling, can secure the privilege of utilizing this surplus stock, to the advantage of both the grocer and herself. The crates of berries, plums, cherries, currants, and other small fruits, which so frequently go to waste in hot weather, can be sent for each night, or as often as may be necessary, or convenient. The fruit is made at once into jams, marmalades, jellies, and preserves, put into attractive glasses and jars and returned to the shop for exhibition, and for sale. The grocer makes an effort on his part to sell the goods, and, of course, is entitled to a share of the proceeds. In conducting an enterprise of this kind, almost everything depends upon the quality of the preserved goods. It must be equal, and if possible, superior, to that of the regular lines of such goods carried by the grocers. An effort should also be made to achieve a measure of individuality in the display of the jellies and preserves, by securing odd, and pretty, receptacles to hold them. Most women buyers are attracted by a novelty in this line, and will often buy an article that they really do not need, or want, simply because it is so daintily packed for the market.

In addition to utilizing the greengrocer's oversupply of fruit, there is much to be done with the vegetables, in the way of various pickles, catsups, and sauces. The details of this work should be carried out in the way indicated for the handling of the fruit.

Properly approached on this subject of co-operation, any grocer will gladly give the proposition his attention. And when he finds that you are in earnest, and that you really make it possible for him to reimburse himself, in part, or perhaps wholly, for the losses he sustains in the carrying of perishable stock, he will lend to the enterprise his very best assistance and encouragement.

In addition to this line of work, a few women have found it profitable to make a similar arrangement with the butcher of their neighborhood, for the utilization of waste meat. The odds and ends of fresh meat, the bones, the fat, and the tallow, can be turned into salable goods, by the hands of a clever woman. Soup stock is the best-paying article in this line. Fresh, rich stock, in substantial glass or earthenware jars, returned to the butcher shop once or twice during the week, will soon find customers among the regular patrons of the shop. Here, as in the matter of the fruit products, everything depends upon the quality, and the dainty packing, of the goods.

# FLOWERS

Gardening seems to belong naturally to woman's sphere. The fragile character of the plants demands the care of the tenderest of hands, and their sometimes slow growth requires a high degree of patience on the part of the gardener. In the bright, brisk air of the early morning, or in the warmth of noonday sunlight, surrounded by a profusion of richness of tint and form, a woman should find health and enjoyment; while from the sale of her products she should receive a substantial income. Profits from the sale of flowers are good, and, if the garden be carefully managed, reasonably sure.

If the garden is to be started from the seed, the outlay of money required is very small. The making of the beds, and whatever other heavy work may be necessary, should be done by a man who can be hired at a small daily remuneration. The seed should be planted in boxes, in the house, early in March, or in a cold frame out of doors, a little later. This refers to gardening in middle and northern America. In the far southern states, flowers are grown out of doors throughout the year. The seeds should be purchased from reliable dealers. At the start, procure a number of shallow boxes, about three or four inches deep, and not too large to be easily handled when filled. Bore, or burn with a hot iron, a number of holes in the bottom of each box, for drainage, otherwise the soil will sour and mold. At the bottom of the boxes should be placed a layer of charcoal or fine cinders, upon which should be placed finely pulverized soil, composed of equal parts of leaf-mold, mellow garden soil, and fine sand. The evening before the planting, these boxes should be placed in a large tub of water, not so that the water touches the soil, but in a way that will permit the moisture to strike through it. The next morning the soil will be ready to receive the seeds.

Large seeds should be soaked over night, and must be planted an inch deep and an inch apart. Smaller seeds, like those of the aster, phlox, and zinnia, should be planted half an inch deep and set in rows; while the still smaller seeds, those of the cosmos, petunia, and pansy, should simply be strewn over the surface of the bed and covered with a sifting of fine soil. After planting the seed, put the boxes in a warm place and cover them with glass, paper, or flannel. The covering should be raised from time to time to admit the air, but do not expose the soil to the full glare of the sun. Should the

earth become dry, moisten it by setting the boxes in tubs of water as before directed.

When the shoots from the seed appear, the covering should be removed. Moisten from time to time with an atomizer, but never when the boxes are exposed to the rays of the sun. When the shoots begin to put forth leaves, transplanting should be commenced. New soil should be used for this purpose. Each plant should be placed in a hole by itself, care being taken to cover the root with soft earth. Keep the plants away from the light for a week, and then place them under the cold frame. As the weather becomes warmer, they may be taken from under the frame and placed in the beds. Choose a cloudy or a rainy day for this operation and handle the small plants with tenderness.

Instead of raising plants from the seed, they may be purchased ready for transplanting; this means, however, additional cost and the likelihood of their becoming damaged before you get them into the ground. Some gardeners, however, are unsuccessful in raising from the seed, and if you find that you are of this number, it will be better to try the young plants. The former method is, of course, more professional.

As the cool weather approaches, the plants should be taken up and removed to the hothouse. Place them in large tubs, or troughs, with holes bored in the bottom. Never water the blooms. A pot with a finely perforated nozzle should be used to water the foliage and roots.

Flowers bring higher prices from October to June than during the remainder of the year. In growing for the market, always have a bountiful supply of roses. The popularity of the rose is perennial. Watch for changes in the public's fancies, and raise in abundance whatever may be the reigning flower for the season. Violets, cosmos, narcissus, sweet peas, and carnations, are always in demand.

A man should be employed to do the heavy gardening and to solicit custom. With a little advertising in the city papers, much patronage can usually be secured; or, if this proves unsuccessful, a small establishment may be opened in town. Many florists do not grow their own flowers, but depend upon gardeners for their supply. It is well, if possible to do so, to negotiate with one florist only, contracting to sell to him your entire product. The demands of his trade should then be catered to with scrupulous care.

You will find, however, that you will soon become known as a gardener, and that you will have frequent calls from town for freshly-cut flowers. Of course, there is more profit in this method of selling, as the producer, instead of the florist, gets the benefit of the margin

between the wholesale and the retail price. This class of custom should, therefore, be cultivated. Never spare pains to arrange artistically the flowers sold to customers. Asparagus is by far the prettiest and the most convenient trimming for bouquets, but fine ferns may also be used with good effect. Smilax is a pleasing adjunct to cut-flowers.

Among those plants which flower first in the year, and before May, are the mezeron pink, winter aconite, hellebore, snowdrop, crocus, pansy, and violet, in frames.

Among the May and June bloomers are currant, azalea, bush honeysuckle, Japan quince, lilac, flowering plum, almond, early spiræa, viburnum, tamarisk, calcanthus, deutzia, mock-orange or syringa, rose, wiegelia, clematis, tulip, hyacinth, narcissus, peony, columbine, lily-of-the-valley, garden pink, hepatica, creeping phlox, herbaceous spiræa, violet, crown imperial, bleeding-heart, Oriental poppy, lychnis, periwinkle.

Summer and early autumn bloomers are monk's-hood, milfoil, Japan anemone, golden-spurred columbine, campanula, sweet-william, plantain-lily, day-lily, and spiderwort.

In fall and winter may be expected chrysanthemums and hellebore while the box and other evergreens, burning-bush, barberry, waxberry, and witch-hazel, are most attractive during these seasons.

# PROFESSIONAL SHOPPING

IT HAS been asserted that all women are exceedingly fond of shopping, and some writers have declared that the pursuit is one that amounts almost to a passion. It may be true that all women at some period of their lives take a great deal of pleasure in selecting, and purchasing, those things that are needed in their homes, but it is equally true that a very large number, particularly those who have grown old, or who are possessed of small means, shrink from the trials and the vexations, which must be encountered in the crowded stores.

Professional shopping is the natural outgrowth of these latter conditions, together with certain others that are equally simple. Most of the women who follow the vocation are possessed of taste, refinement, and a certain amount of business tact. In most cases, they have suffered financial reverses, and are compelled to earn their own living as best they may.

A woman who enters upon the vocation of professional shopper, must be infinitely tactful. She must study the tastes of her patrons, and, even if her own ideas differ from theirs, she must either gratify them, guide them into more correct channels, or expect to fail in her undertaking. She must remember that what one woman regards as ideally perfect, may be looked upon by another as hideous or grotesque. It is the patron, not the shopper, who must be pleased. The taste of the professional shopper, in a majority of instances, however, is deferred to by the patron, who comes to know that one who has made the subject a special study, is better qualified to judge than one to whom shopping has been an occasional incident.

The experience of one young woman who is earning a good income as a professional shopper, may be given as a fair illustration of the class as a whole. As a girl, she was noted for her excellent taste in dress, as well as for her tact in securing bargains. She was not rich, but was in good circumstances, and had received a fair education. When the reverses came that made it necessary for her to earn her own living, she carefully summed up her qualifications for a business career. She could sing, and play, but not well enough to teach these accomplishments. She had a smattering of three or four languages, but she at once discarded the idea of teaching something in which her short-

comings would be so apparent. She was almost in despair, until one of her friends suggested that she become a professional shopper. At first she was inclined to scoff at the idea, but there was nothing else that she felt she could do as well, and, after more or less protracted deliberation, she decided to make the venture.

Her first step was to have some cards engraved, announcing that she was prepared, for a reasonable consideration, to relieve members of her sex from the burden of shopping. She then called on an elderly lady of wealth whom she knew, and asked for her patronage. The lady was glad to have her services, and was so pleased with the result of her first commission, that she went out of her way to recommend the girl to others. While a clientele was being built up in her own town, the young woman tried the experiment of advertising in a suburban newspaper, offering her services as a shopper to those living out of town, who might find it inconvenient to come into the city to make their purchases, and who, thereby, were likely to lose the advantage of desirable bargains. As a result of the first advertisement, she received more than a dozen orders.

That particular young woman now has an office, and gives employment to four other professional shoppers. Her charges are reasonable, as they necessarily should be, inasmuch as she can, in a single visit to a department store, fill the orders of a large number of patrons. She had not been in business as a professional shopper very long, moreover, when the shopkeepers discovered that her custom was exceedingly desirable, and that they could afford to pay her a commission to patronize them. At the present time, the young woman receives a commission from the patrons for whom she buys, as well as from the merchants at whose stores she makes the purchases. Her commission from the former is twenty-five cents on each order, whether it be large or small; and from the latter, it is five per cent. on the total amount of the purchase.

There are now numbers of professional shoppers in all of the large cities, and as a rule, they earn fair incomes. There are, however, unpleasant features connected with this, as with all other employments. Occasionally, a patron will be exasperatingly ill-tempered, will find fault with everything the shopper does, and may even refuse to accept the purchased materials. Under such circumstances, the shopper must preserve her equanimity, lest she lose her patron altogether. Those who have tact enough to succeed as professional shoppers, however, generally have the accompanying characteristic of patience.

Any young woman who has the requisite qualifications to become a successful professional shopper, can enter the field by following the method adopted by the girl to whom particular reference has been made.

# CHEMISTRY

CHEMISTRY is a pursuit with which it is not safe to trifle. A little learning is a dangerous thing. The subject should be mastered or let alone. The best way to master it is to take a course which embraces that study, in one of the leading colleges or universities. Such a course will cover a period of four years, in addition to the preparatory study first needed for entering.

This university course will include many branches not essential to a knowledge of chemistry, but some, like physics, cannot be dispensed with. A good knowledge of French and German is required, owing to the fact that the most recent scientific books and pamphlets are not accessible through translations.

After mastering the subject, there are many, and widely divergent, branches of practical work open to the chemist. A good occupation for a woman is that of drug clerk. This demands familiarity with chemistry and *materia medica*, and a general knowledge of botany. One who has had a complete theoretical course may easily learn pharmacy and dispensing in the drug store itself,—pharmacy having been termed the "cookery" side of the drug business.

A position in a chemical manufacturing house, such as supplies the drug trade, has decided advantages. The salary is good from the very first, there are opportunities for practical improvement, and the position furnishes a good stepping-stone for further advancement.

Government positions offer excellent facilities for continued research in the mysteries of the material world. To one who loves to teach, the high schools of the land furnish the proper sphere. First-class woman teachers of physics and chemistry are receiving almost the same remuneration as do male teachers.

# ARTIFICIAL FLOWER-MAKING

As a profession for women, artificial flower-making can scarcely be said to hold out the encouragement that is to be met with in other lines of effort, but, at the same time, this work may be brought to such perfection that there will be a demand for a special line turned out by the true artist. Just as long as women wear head-gear demanding ornamentation, just so long will continue the demand for the artifices that are a factor in beautifying that adjunct of the toilet.

A course in one of the practical schools is the best way in which to acquire a knowledge of flower-making. The materials ordinarily used in the making of flowers are silks and velvets; though the commoner varieties of cloth go into the making of the cheaper grades. Then there is the rubber for the stem; the beads, wire, paint, dye, and a hundred other things that are found necessary if the whole gamut of the artificial flower-maker is to be followed. It has never been discovered just how many varieties of flowers adorn the hats of women, but there are many wonderful creations of the maker, that outvie anything that Nature has had the temerity to produce.

It is the firm belief of those who are well informed on the matter, that a factory for the manufacture of artificial flowers, judiciously managed and operated by women, would be a paying venture, and if a millinery establishment were added to this, the investment would prove a bonanza to the owner. Such an enterprise would naturally require the investment of considerable capital, and there would be many difficulties to meet and overcome.

Not very long since, all artificial flowers were imported into this country from France, and the most of them came from the city of Paris. The growth of all lines of manufacture in America has done away with this, and now there are more flowers made for the home trade in the city of New York than are imported. Even a large proportion of the most expensive sorts are home-made, and all of them rank, even in the highest classes, with the imported flowers. A start may be made, as in all things, on a small scale, and if the work is good, there will be sufficient demand for it to counteract the competition that is sure to begin when the great manufacturers learn that a rival is in the field. A careful canvass with samples among the high-class milliners, would be an effective way in which to begin, and if the work is good, and the prices in conformity with those current, the

result will always be found satisfactory. People in trade are ever on the alert for good materials at low prices, and the reward for furnishing these things is certain. In few instances where this manufacture of the material and the finished article has been tried, have failures been noted, and then only because the operators were not up to the requirements of the entire business.

Bearing in mind all that is necessary to success in any line of work, women should have more than a fair chance of succeeding in the making of flowers, and in the manufacture of hats and bonnets.

# ARE WOMEN SUCCESSFUL IN TRADE AND FINANCE?

SIMULTANEOUSLY, four women in New York City failed in business, not long ago. The fact that they should all have gone into bankruptcy at the same time, though each had been conducting her business separately, aroused a discussion as to whether or not women in business are successful, and, if so, why? Most of the women who have contributed to the accompanying symposium are in trade, and their ventures have been crowned with success. What they have to say on the question is therefore most timely.

A woman prominent in the anti-suffrage movement has this to say about "Woman's Success in Business": —

"Women have been successful in business ventures which cater to women's needs. If a woman is forced by circumstances to support herself, let her work along the lines of those women who have built up and are carrying on a business that is essentially a womanly one. Women have been successful lawyers, physicians, and architects, when they confined themselves to the womanly part of these professions. I do not think a woman should go into the criminal courts and argue a case. I am certain no woman should be a surgeon. Her physical make-up is not such as would permit her to perform surgical operations successfully. I think a woman could attend to the interior details of a house much better than could a man, but I do not think her capable of planning and carrying out successfully any large building.

"In my opinion, women have been successful as college presidents, teachers, and along all lines of educational work. Women should be on the school boards, not through election, but because they are best fitted

for the place. I do not wish to be understood as saying that a woman should not enter business life, but if she must, let her choose her profession and trade in woman's field, not man's.

"A woman does wrong to enter into competition with men, unless driven to it by necessity. When she does, she invariably takes the means of livelihood from some man with a family depending upon him. When God created woman, He gave her peculiar attributes. He made her loving, more patient, more self-sacrificing, and gave her greater powers of endurance than He gave to the other sex. He made her to be man's helpmeet. He placed her on a higher moral plane; and standing where her Creator placed her, her influence over the men of her family transcends any other. Therefore, why try to invest her with powers other than those with which she is endowed by God?"

Mrs. Russell Sage says "Woman, when designed by her Creator, was never intended for business. God made her to be a home-maker and home-keeper, not a wage earner. She may take up business life from necessity, but never from choice.

"All a woman's early training tends to fit her for wifehood and motherhood, through which qualities she becomes the home influence, but in no case is she trained for financial and commercial life. Therefore, if from unforeseen circumstances she is thrown out into the world to earn her livelihood, she is seriously handicapped.

"The self-abnegation and trustfulness of woman are great stumbling blocks in her path to financial success, and it has always seemed a pity to me that men should lose the better part of woman in what she is trying to do outside of her natural functions.

"In saying this, I do not wish to be misunderstood. I do not belittle woman's capabilities, for I am firmly convinced that, notwithstanding her many disadvantages, when she is put to it, she is man's equal, if not his superior. Were a woman trained as a man is, she could easily take her stand side by side with him in the financial and commercial world, but I pray I may be spared that sight.

"The better part of woman, as God made her, is so essentially feminine and dependent that it grieves me to see the growing tendency of the age toward welcoming her into the arena of business life. To be a successful business woman she must have a man's brain; and in gaining this, she ofttimes loses her womanly charms and characteristics. I am so thoroughly old-fashioned, myself, that I shudder to see a woman enter the lists against men, and yet I know in many cases she is driven to it against her will. If she must go into business life, if this is to be the future of the coming woman, then it is the duty of mothers and fathers to train her for such a life as that for which they train her brothers."

Rosalie Loew, lawyer, says: "From my observation, I believe that many women lawyers have achieved success from the financial or commercial point of view. I have observed also one or two unfitted for the work, and these are not successful. There is no profession, I believe, in which merit is more the measure of success than in this one, where there is a more certain expression of the survival of the fittest. It is not necessary to refer to the rules, for I believe that women have neither advantage nor disadvantage in legal work by reason of their sex. Certainly, if there is any changed position, it is a disadvantage, because of prejudice. I have never consciously met this prejudice, and do not believe it exists, but I have heard other women lawyers complain of it.

"At least one woman in New York City has achieved success as a patent lawyer. A few are doing well in general practice. Several are part of the machinery of large offices; many are doing brief and office work of the very best and most valuable kind, for husband or brother. In short, there is no room in this noble profession for feminine or masculine incapacity; but ability and character will inevitably find their place, and meet that appreciation which brings financial success."

Julia W. C. Carroll, shirt-waist maker, says: "Of course I think woman in business is a success. It has been both my experience and my observation that women who apply themselves earnestly, make money, but it is not on the financial side that they oftenest fail or suffer loss. It is on the side of personal sacrifice.

"My serious views on 'Women and Business,' if worth listening to, are soon told, but I must add the opinion of a successful man, whose views on business must be of more value than mine; for, though I am grateful to my customers for the success that has come to me, I cannot but concede superiority in commercial matters to the other sex, even though necessity demands that some of us must do for ourselves. I, for one, am only too pleased to put the superiority on a pair of broader shoulders than mine, for the average woman who succeeds in business does so for different reasons than do men.

"The successful commercial man is usually able to take a broad, comprehensive view of matters, which, however, does not allow minute details to escape. If he sell blankets, he buys sheep wholesale, clips the fleece, refines the wool, and manufactures it into blankets. When the blanket is ready to sell, your man knows not only what it has cost him to make it, but what per cent. of that cost is represented by raw wool, how much by the cost of the labor, how much by the pro-

portionate share of his rent, heat, light, interest on his investment, etc.; how much for dye, for wear and tear, and for the thousand and one other details that go to swell his expense account.

"Women, on the other hand, business women who succeed, usually do so because of their inventive faculties, imagination, and adaptability. They are able to turn these qualities to sufficient account to be able to pay less attention to the methods which bring success to men."

Helen Harmon-Brown, milliner, says: "'Women,' said Rousseau, 'have or ought to have, but little liberty; they are apt to indulge themselves excessively in what is allowed them. Addicted in everything to extremes, they are even more transported at their diversions than boys.'

"With what scorn would this statement of long ago be received by the twentieth century woman; and yet how truly has Rousseau gauged the secret of the success of this same scornful modern woman!

"In this day of 'untrammeled womanhood' to say that 'woman ought to have little liberty!' Whatever my sentiments, I should hardly dare, in the face of the storm it would raise, to express myself in favor of such a statement. Let me therefore ask the patience of your readers while I quote further: 'They are apt to indulge themselves excessively in what is allowed them.'

"My limited experience of four years in a distinctly feminine business hardly warrants an expression of my views on the broad subject of women's business ability, but it seems to me that the ability to go to extremes in everything, and to throw themselves heart and soul into their chosen vocation, is just the trait that will eventually enable them to succeed. The present conditions, which compel women to go out of their natural sphere, may or may not be the result of their own actions. Certainly these conditions exist, and for the present must be endured or overcome by women unused by previous training to any struggle.

"How is this done by the successful woman of to-day? Much in the same way as by the successful man, except that the woman never stops work night or day. The really earnest woman plods, and as a result succeeds, but at what cost?

"It has been asked: 'Can a woman succeed in business without the assistance of a man?'

"To this I would answer, 'It is possible, and has been done.' But at the same time I would like to lay special stress upon the fact that if a woman does do this, she is most unusual and is doing more than the ordinary man.

"What young man starting a business venture does it entirely unaided by the advice of a more experienced man? Would he not be looked upon as foolhardy if he did? Why, then, should a woman be considered inferior in business ability if she so far follows the example of the 'sterner sex'?

"With no business training, no hereditary training of thought, and with all of her experience gained by her mistakes, is it not remarkable that there are any successful business women from the leisure class?

"The great lack among women with whom I have come in contact seems to be executive ability; and this is well expressed in the following quotation from a recent magazine article:—

"'The whole gain of our civilization, and of woman's highest welfare, lies in making the present need bend to the future requirements, in accepting present loss for future gain, in taking long and longer chances. Women need surely to study these duties more scientifically, more as a whole, instead of this daily whittling away of their lives over the separate parts. The great object of life is life—restful, strong, beneficent—and we women who desire earnestly "the best things" for ourselves and our households must do less plodding and more planning; less sacrificing and more intelligent contriving; we must have less guess-work and more accurate knowledge. We need to gird ourselves daily for a climb to the "thinking levels," where we may feel the cool breath of heaven and receive inspiration from the larger view.'

"This paragraph, though referring more especially to the household, applies equally to business women, whose 'household' includes many strange natures, and whose opportunities for work may give them a wider range of influence."

The Misses Tucker and Babcock, florists, say: "The fact that four women have been cited as having gone into bankruptcy, seems a slight foundation for a discussion of woman's fitness for business life. These women, for instance, had, not improbably, undertaken to carry on enterprises which circumstances had thrown on their hands, and which were, possibly, in unprosperous conditions when taken up.

"Surely there are cases innumerable of other women in trade who successfully conduct the business left to them by the death of husband or father, relying only on their native common sense to manage affairs for which they were never educated, in addition to the burdens they are expected to shoulder as a matter of course.

"The many milliners and dressmakers who have made money must have had excellent business ability, for most have started from very

small beginnings. It can hardly be asserted that in business for which women have been fitted or prepared they fail more often than men.

"When a woman fails, in the new lines into which circumstances have forced her of late years, to successfully compete with man, it is, perhaps, because she attempts the impossible. The difficulties she contends with are many — more than those of a man in the same circumstances. Compared to the man, the woman is like a pioneer who clears the lands, hews the logs, and builds the house with rough tools, and with the materials found at hand. The man, on the other hand, has been properly taught to first draw his plans, using the accumulated result of civilization, and works with a cleared lot, prepared lumber, and associated labor.

"A highly cultivated, intellectual woman starts in business without education or experience in the work she undertakes, and with little or no capital to invest. She is averse to recognizing her limitations, and tries to hold on to social and home duties, while competing with men on their own ground, and under difficulties which men rarely have to face.

"If she is working for an employer, her hours are of reasonable length, and she can take a proper amount of recreation; but, if she is her own mistress, her hours are practically without end, her meals are hurried and insufficient, and every thought is so concentrated on the struggle for existence that recreation and repose are lost sight of until a case of 'nervous prostration' teaches her that her brother's methods are more practical than hers, and that it pays literally to spend a reasonable amount of time and money for amusement and appetizing food.

"If the time ever comes when women are trained to the work they undertake, instead of starting on a capital of 'intuition and pluck' as so many have done — and successfully, too — they will learn to systematize their work and their play, and will leave such phrases as 'I haven't time!' and 'I'm rushed to death!' to those who make a business of society."

K. C. Budd, architect, says: "The chief difficulty of women in business is that they are seldom properly trained in the beginning. From the seamstress, whose work is more or less inefficient, as contrasted with that of her brother, the tailor, up through all the grades, this defect is found. Unfortunately, she herself is seldom conscious of this failing. She blames the world for owing her a living, yet failing to pay her as well as it does a man, and continues to tantalize her employer with her unworkmanlike ways. The education and training calculated to give her systematic ways, and a clear under-

standing of her own powers and limitations, will be of value in any condition of life.

"Kipling paints her in the ''Eathen.' Let a woman once realize that she must be 'gettin' rid of doin' things rather more or less;' let her resolve that, whether it is possible or not, she will do it. As each day begins, she will feel that the 'Master of all good workmen has set her to work anew,' forcing her work to a higher standard, nearer to that artistic ideal when—

"'Each for the joy of the working and each in his separate star
Shall paint the thing as he sees it, for the God of things as they are.'

And the world will certainly be the richer for her existence, whether she herself succeeds or fails in making a fortune."

Floride Green, photographer, says: "If success means the ability to support herself, woman has answered the question; if it means providing for those dependent on her, she has succeeded at that again and again; if it means building up a commercial business, she has certainly accomplished that. Few women go into business until forced by necessity, and that usually means a start without capital. With this handicap, business after business, entirely owned, managed, and carried on by women, has been built up and has grown.

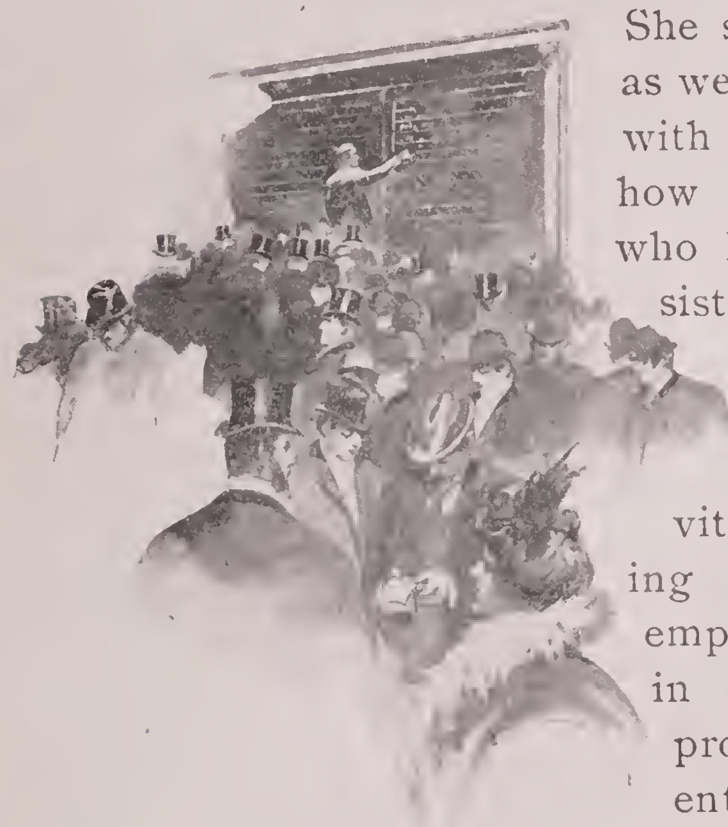
"To me, no work seems so well adapted to women as photography, and no woman is so well adapted to photography as the American woman, for she is the blending of many nations. To be a successful photographer, she must have the determination of the English, the cleanliness of the Hollander, the chic of the French, the discrimination between light and shades of the Italian, the love of lines of beauty of the old Greek, and the commercial instinct of the American.

"For some years, I was the only woman who had a studio in New York. Now, besides Mrs. Kasebier and the Misses Selby, there are several others who are doing as much work and as good work as the men whose studios they took. In Washington, no one is more of a success than Miss Frances B. Johnston, and in London, none outranks Miss Alice Hughes."

# THE AMERICAN BUSINESS WOMAN

*By CHARLES A. CONANT*

THE conditions of to-day, especially in cities and towns, are very different from those of a half century or a generation ago, when life was more simple in its organization. It is of the first importance that every woman, whatever her present condition or future prospects, should know something of the simple rules of business.



She should know the value of money, how to keep it as well as how to get it, how to deal with banks, and with trust companies, how to make investments, and how to protect herself against plausible swindlers who have wrecked the fortunes of so many of her sister women.

Knowledge of business methods is almost equally necessary for the poor woman and for the rich woman. For the poor woman, it is a vital aid in making her way in the world,— in making her services useful where she is employed, in employing her earnings to the best advantage, and in investing her savings in the safest and most profitable manner. For the woman of independent wealth, even if she is surrounded to-day by the safeguards of family, there may come a time when the management of her fortune will demand some of her own attention. Cases in which relatives or friends who were trusted, or at least supposed to be faithful, have taken advantage of ignorance and indifference, have been too numerous to justify either man or woman in neglecting their business relations. The man or woman who seeks a life of ease, social diversion, or literary culture, can, perhaps, safely intrust many details of his or her business affairs to others; but some degree of supervision should be exercised over one's affairs, and such supervision should be supported and directed by intelligent knowledge of investments, bookkeeping methods, and the laws of property.

The practical woman, moreover, however great her wealth, and however little time she cares to waste upon its management, will find a knowledge of business methods of the highest importance in making herself useful in the world through her charities. The difference

between a knowledge of business methods and of the character of investments, and ignorance of these subjects, on the part of women, has often, in enterprises of charity and philanthropy, made the difference between success and failure. Failure in cases where a profit is expected, cannot be excused upon the ground that some good has been done. Enterprises of such character are subject to the law of competition. What is beneficial to the community will prove profitable by attracting patronage, and that which is employed in a wrong direction will prove its comparative lack of value by its lack of appeal to popular wants.

In the articles which follow, will be set forth what are the legal relations of the business woman, whether married, widowed, or maiden; how she should keep her bank accounts; how she should deal with trust companies, and savings banks; how she should make investments, and how she should seek to protect them against fraud, and loss. It may be stated as a preliminary requisite for the success of the business woman, that she should know the amount of both her income and her outgo, and that she should be systematic in her record of them. Education in business methods should begin in girlhood. Many a woman would have been saved much humiliation and suffering, if she had been taught at school some of the rudiments of bookkeeping, banking, and investments, even at the expense of more ornamental branches of learning, too often forgotten after leaving school. No budget of money received and spent is too modest to warrant one in neglecting to keep a small cash account. The child, as soon as he or she appreciates the value of money, and is allowed to earn and to spend it, should be furnished with a small book ruled for dates, items of income and expenditure, and dollars and cents, and should be told to enter on one side the money he receives, and on the other, the money he spends. Even if these first entries are limited to twenty-five cents, for helping to weed the potatoes or for washing the dishes, and the expenditures amount to only a few pennies for candy or marbles, the opening of an account will lay the foundation for system in one's methods, and for keeping a true balance between receipts and expenditures in later life. There may be occasions when unusual traits of miserliness in the child may suggest a different policy; but for the great majority of children, it is well that their training in the hard realities of the struggle for bread should go at least as far as a knowledge that one should keep his expenditures within his income. It will be easy, with a small account of this character, to encourage saving in order that a favorable and growing balance may always be found upon the credit side of the account. Then, when these savings amount to a few dollars, the child

may well be introduced at the savings bank, and stimulated to feel pride in keeping his or her own bank account.

For the more mature woman, and the mother, system in money matters will be not only useful to herself but of great assistance to the father and bread-winner, in meeting the demands of family life. Several separate accounts may perhaps be profitably kept by the wife in the family. A separate account of all expenses in the conduct of the household will throw light on necessary retrenchments, or on possible opportunities for larger expenditure, and will at the same time constitute a useful record as to the date of expenditure. A separate account of personal expenses is advisable for each member of the family. If the wife is fortunate enough to have a fixed allowance, one side of her account will exhibit the amount she receives month by month, and the other side will show for what she has spent it. The system of keeping the household and personal accounts separate will aid her also in retaining for her personal use all of her allowance, and in reimbursing herself on this account for any expenditures for household purposes which she may make, in emergency, from her personal funds. An account of personal expenses can be kept, even where there is no fixed allowance to the wife. She should enter each separate sum given to her by her husband, or received from her own fortune, if she is fortunate enough to have independent resources.

For the woman of considerable property, it is especially desirable that there should be a systematic record of what she has, of what she receives in income, and of what she pays out for the expenses of maintaining the property. These matters will sometimes be in the charge of a lawyer, agent, or steward, but this should not prevent the woman from keeping in her own hands some memorandum which will afford exact knowledge of her income, from what it is derived, and how it is spent. Each separate piece of property should be considered by itself, with a view to determine its earning powers, and whether it is worth keeping or will better be changed for something else.

It is advisable that the women of wealth, as well as persons of moderate means, should save something from their incomes. It is not necessary to repeat here all of the reasons given by moralists and philanthropists as to why even the poorest should seek to lay aside a small part of their income for emergencies, and for investments which may enable them to live more comfortably in later life. It is often thought that the woman of wealth can afford to spend all of her income. This, however, is far from being the case in the usual sense of the word "income." All men and women having property which they desire to maintain, should at least set aside a certain percentage each year to cover the decline in its value. This is what is called

a "sinking fund," in a mill or factory, where great miscalculations would be made, if the machinery were treated as retaining full value for many years and dividends were consequently paid without deduction upon the net business done. It would be suddenly discovered some day that the old machinery had lost its value, and that nearly the whole capital, which was counted upon to provide the income, had disappeared. Men or women are likely to find themselves in the same position,— and often the discovery will come as a sudden shock,— if they undertake to spend every penny paid over to them for rentals, or as the income from investments. The discovery that a house needs thorough repairing in order to keep it in condition for renting, the announcement that a railway has suspended the payment of dividends, or the rise of prices in proportion to a fixed income, will all present problems that will be especially troublesome to a woman, if she is accustomed to spend every penny received from her investments.

Even where the property is itself of a high quality, accidents often occur which deprive it for a time of income-paying power. A house which has paid a good rental may stand vacant for several months, or even for years. A railway which is earning large dividends may suspend them in order to use its entire earnings for extension. In such cases as these, the person who is accustomed to spend her entire income, will, when she finds her dividends reduced, feel the pinch of poverty. It would be much better to live upon a scale well within one's income, and to accumulate a surplus fund, as banks and insurance companies do, to tide over periods of impaired resources. There are also emergencies in life which call for special expenditure that should not be disregarded. Illness, with its attendant large bills; marriage, with the expense of a *trousseau;* death, with its sad charges, are likely to make demands which are embarrassing, even for the person of wealth, if she is accustomed to employ all of her income in the ordinary expenses of living, dressing, and entertaining. Such expenses can be met from one's principal, but this impairs the income for the entire future, and creates a condition of poverty very different from that which necessitates the expenditure of a part of one's surplus, saved from the income of previous years.

Careful calculations should be made in advance as to probable income, and expenditures should be kept well within it. Where a woman of means manages her property through an agent, she should enter on the debtor side of the account each check which she receives from him. Whether the records regarding investments are kept wholly by the agent or are kept by the owner of the property, they should be separate from the personal account. The checks received from the agent usually represent the net income from property, after deducting expenses, and might

properly be entered on the debtor side of the account. When the record of property is kept by the woman herself, however, she should make, on her books, formal transfers from the account dealing with her property in investments to her personal account. It will not be necessary to keep separate bank accounts, or two separate sums of money in one's hands, if the two book accounts are properly kept and balanced. For instance, a woman receiving $50 in cash for rental, could take it directly to the dressmaker to pay a bill, provided she credited her property account with the receipt of the rental, transferred the amount of the books from one account to the other, and charged her personal account with the expenditure for the dressmaker's bill. It is the books, in other words, which should be kept separate,— not necessarily the money itself or the bank accounts, where the amounts are not large. Where the properties are extensive, it may be desirable to keep a separate bank account, and to draw checks between one account and the other in order to maintain the distinction. The method of beginning an account at a bank, and information in regard to carrying it on, will be set forth hereafter. Care should be taken in dealing with checks not to make duplicate entries of a single item. If, for instance, a check is entered as a receipt, it should not be again entered as a receipt when it is deposited in the bank, and its proceeds are received in cash. The bank account should be carefully kept in itself, but so far as it is related to the property and to personal accounts, the credits at the bank may be treated as cash and not separately entered.

While the business woman should have a knowledge of her property, how it is invested, what returns it yields, and how property is managed, it by no means follows that she should undertake to attend to all of her business herself. It is much better to employ an agent for the renting of houses, to employ a trustworthy broker for dealing in stocks, to retain a lawyer for drawing important papers or meeting legal difficulties, and to employ a trust company or a banker for a variety of business operations. The woman who undertakes to do all of these things herself will meet many obstacles and be subject to many petty deceptions and frauds which are not often attempted in dealings with experienced agents. The real estate agent knows all of the tricks of tenants, and knows the laws which govern rentals. The business woman, while it is desirable that she should know some of these things, could hardly expect to know them as well as does the agent. The same rule will apply to other transactions. Where

the services of a competent agent can be obtained at small charge, he should be employed in transactions of a technical nature. There are cases in which a woman is able to make a specialty of some of these occupations. If she owns many houses, and wishes to give much of her time to their care and supervision, as a means of filling her life, such action may be justified, but in that case she must take the place of the agent in technical knowledge, and must be prepared for mistakes at first, for careful study of details, and much consumption of time. For the woman of independent resources, even where they are small, the modest charges made by competent and trustworthy agents will be more than offset by the protection they will afford against blunders, and the greater the freedom she will enjoy for her family and social life.

There are many classes of investments which will be urged, with plausible reasoning, upon women with money. Many of them have merit, but some involve more care than do others, and some are more subject to business fluctuations. The woman who receives property suddenly, however,— whether through the death of her husband or by inheritance from some distant relative,— usually finds it already in the form of investments. She must then determine whether any of them are so unsatisfactory, unsafe, or troublesome, as to require their change into another form. Even where they are not altogether the best possible investments, it is likely to be found that a change will involve a greater sacrifice than the acceptance of what can be earned from the investments as they are. The management of real estate, and the principles in dealing in securities, will be discussed in future chapters, but a word may be said here of investments of a general character, which involve little risk or care for the investor.

One of the best investments for a woman having money that she wishes to save and increase, is to put it in the form of life insurance in one of the notably strong and great companies. If she is healthy and still comparatively young, the insurance may be upon her own life as profitably as upon that of any other; but if advanced in years, or of poor health or weak constitution, the insurance should be upon the life of husband, son, or daughter, or upon that of some other near relative. Whatever life is insured, she is to be named in the policy as the beneficiary. In taking life insurance for an investment, it is better to take a policy maturing in ten, fifteen, or twenty years, if the life insured should last so long, than to take a policy payable at death only. Yet, upon a policy payable only after the death of the person whose life is insured, the company is always ready to redeem the insurance upon perfectly fair terms, so that no serious mistake can be made, whatever form of policy is taken. One of the

advantages of putting money into life insurance is the certainty of being able to draw it out, after the first two or three years, upon terms the justice of which, in any particular case, is calculated with mathematical accuracy. Nothing else in business equals the nicety with which the true value of a life policy is ascertained, when a settlement of it is to be made, either before or after maturity.

If a woman investing in life insurance has the means to take a paid-up policy on the life insured, that is the best policy to take. But she should not too greatly reduce the amount of insurance merely to enable her to pay the whole premium at once. For should the life insured terminate much earlier than the average of such lives, the paid-up policy will have cost much more than if the premium had been a yearly one. If she has not money enough to take a paid-up policy, or prefers the chances of an annual premium, she can pay in advance as many years as her means permit, and the company will allow her interest on the advanced payments, and return the excess, if the insured life ends before the advance payments are exhausted.

Life insurance may be taken on the life of debtors, business partners, agents, trustees, or upon the life of other persons whose death would cause loss to the persons seeking the insurance. Under such circumstances, the client may insure the life of a lawyer; a litigant, or prospective litigant, the life of a witness whose testimony could not be replaced by that of others; a person supplying funds for the development of an invention, the life of the inventor; or the financial backer of any lawful enterprise, the life of a person upon whom the success of that enterprise depends. Any person seeking to insure the life of another, must have what is called an insurable interest in the life of that other person; that is, a good, substantial reason for desiring the life of that person to continue. For instance, a person having the possession, use, and profit, of real estate or personal property during the lifetime of another, may insure the life of that person, as an offset to the loss which the death of that person will necessarily occasion when it occurs.

Life insurance is almost entirely effected through agents of the companies. Such agents are very numerous, exceedingly persistent, and given to much exaggeration of the merits of their own companies and systems, with excessive depreciation of their rivals. Nevertheless, an applicant for insurance who listens and says nothing will find agents helpful in determining the best kind of policy to fit the particular case. Some companies are better than others, but all in the first rank are good enough for anybody.

Life insurance policies are good securities for loans. When the loan is desired on the security of a policy insuring the borrower's own

life, it can probably be obtained from the company itself on better terms than would be granted by an outside lender.

A system of life insurance based on assessments determined by the actual number of deaths among the insured, instead of a fixed premium based on the average death rate, has been very popular, because comparatively cheap; but it has failed under the severe test of long and actual experience, causing great loss, anxiety, and misery. While some of the assessment companies have broken down under bad or unfaithful management, others have fared as badly, though managed with great skill and fidelity; thus proving that the system is unsound under the very best of circumstances. These remarks do not apply to the weekly payment system known as industrial insurance, when worked by large and sound companies whose premium rates are fixed conformably to the principles for fixing annual premiums. Industrial insurance is more costly than is annual premium insurance, but the small weekly payment is hardly ever missed, and wonderfully lightens the always heavy burden of the poor when death comes to the insured.

Savings banks pay but small rates of interest, but when well established, well reputed, and well managed, are good and convenient means of investment. That form of savings bank known as a building association, which is actually a land bank, since its loans are made only upon real estate security, pays a higher rate of interest than does the ordinary savings bank. But the large, and general fall in the interest rate upon real estate loans, and the increased attractions and facilities offered to mortgage borrowers by other kinds of lenders, have cut largely into the field of building associations, and their importance has much declined. For those to whom, whether as investors or borrowers, the inducement and habit of making regular payments at short intervals are profitable, building associations still have their uses; but dealings with them should always be based upon a sufficient knowledge of how, and by whom, they are managed. For this reason, investments with, and borrowings from, a building association situated away from home are not to be commended.

Associations or companies formed to purchase land, to build upon it, and then to sell it off in houses and lots, often come to the attention of a woman having moderate amounts of money in lump sums, or able to make monthly payments for a considerable period. These are not safe investments for inexperienced persons, since the land is usually charged to the shareholders at a material advance upon its actual cost or value, and the expenses of management for a company or association, are generally much larger than where an individual is managing the employment of his or her own capital. The like

caution applies to investments in distant mining or other enterprises, in which shares are sold for small payments outright, or for a small payment down, and periodical payments thereafter. Any person who looks for large profits under the management of others must take large risks. This is apparently not true of well-established corporations, such as banks or insurance, trust or manufacturing companies; but the shares of such companies command a price that leaves only a moderate profit to the investor.

A good form of investment is a first mortgage, to the amount of not over seventy per cent. upon the well-ascertained value of productive or improving real estate. Here the lender must be sure that the title is good; that everybody concerned in the title is included in the mortgage, and that there are no unredeemed tax sales attaching to the property. The buildings forming part of the security are to be kept insured under control of the lender; all taxes due are to be paid at the time of the mortgage, and the lender should yearly ascertain from the tax officers the state of the taxes upon the property; for taxes have precedence over mortgages. If there is repeated difficulty in obtaining the quarterly, half-yearly, or yearly, payments of interest due upon the mortgage, the lender should not too long delay an enforcement of the terms of the mortgage.

Second mortgages habitually carry high rates of interest, but are unsafe for any but those who make a specialty of dealing with them. The holder of a second mortgage must keep informed of the state of the first mortgage, and be prepared to take it off the hands of its holder, lest the second mortgage be cut out by foreclosure of the first.

Chattel mortgages, which are mortgages on movable property left in possession of the borrower, are also unsafe investments for inexperienced persons, who are liable to find their money and security lost, and nothing left but the worthless paper on which the mortgage is written. To lend money on jewelry or other costly property deposited with the lender may be safe, but to take pledges for profit is to engage in the business of a pawnbroker, a trade requiring a license and subject to special regulations by law.

A precaution that should invariably be observed by a business woman in managing her affairs, is the taking and keeping of receipts for money paid. The preservation of receipts will often avoid dispute where mistakes have been made by tradesmen, and will always afford protection against a fraudulent attempt to collect money that has been once paid. Merchants usually send in their accounts on printed bill-heads, which should be receipted by their signature, or by that of a responsible agent, when the account is paid. In other cases, where

the person receiving the money is not a merchant or does not do sufficient business to have the proper stationery, the person paying the money should have blank receipts for signature. A form of these receipts is printed herewith. The receipt should give the date of the payment, the name of the person from whom the money is received, and the nature of the account upon which the money has been paid. The receipt presented shows that Mary Maloney rendered services to Mrs. Jane R. Smith, for which she received full payment up to the date of the receipt. Mrs. Smith appears to have filled out the body

**Cripple Creek, Col.,** Dec. 22, **19**

**Received from** Jane R. Smith

Eighteen **Dollars**

in full for domestic service from Nov. 10, 1900

$ 18.00 Mary Maloney

of the receipt, leaving only the signature to be affixed by Miss Maloney. A person signing such a receipt should examine it to see that it sets forth correctly the amount received, the date, and the purpose of the payment. The use of checks in making payments affords some of the safeguards of a receipt, since a check cannot be collected without its presentation to the bank upon which it is drawn. The bank holds it subject to the order of the drawer, who can use it, if necessary, as evidence that a disputed payment has been made.

One of the warnings in regard to business which cannot be too strongly impressed upon women is that they should firmly refuse their endorsement for notes made by others. A person desiring to borrow of a bank often asks the endorsement of some friend, upon the representation that it is merely a formality, and that in order to comply with the requirements of the bank, two signatures shall be attached to the note. An endorsement of this character makes the endorser liable for the whole amount of the note in case the maker is unable or refuses to pay it. The endorser is legally liable and is

not permitted to prove against an innocent holder of the note that he or she received no consideration for assuming the obligation. The fact of endorsement is presumptive evidence that there was consideration, and the courts will not waive this presumption, to the injury of the bank or whoever may hold the note. While persons ignorant of business methods, and without large resources, might seek endorsements of this character innocently, it is rather a subject of suspicion than otherwise when they are sought by men in business. It indicates that their credit at the bank is not strong, and that if a note is accepted with the endorsement which would not be accepted without it, the bank looks to the strength of the endorser rather than to that of the maker of the note. A person endorsing a note for a friend, with whom he or she is not carrying on such business operations as naturally involve mutual endorsements, should consider that he has loaned the entire amount of the note, and that the chances of getting it back depend entirely on the willingness and ability of his friend to pay it. Careless endorsements for friends have wrecked many business men, and even large banks. It was endorsements of this character that brought William McKinley to the brink of penury some years ago, and led some of his admirers to raise a fund to protect him from ruin.

A promissory note is defined by Chancellor Kent as « a written promise, by one person to another, for the payment of money, at a specified time, absolutely, and at all events.» These conditions demand special attention, because each embodies points of law which have been the subject of many judicial decisions. A note which does not conform substantially to these requirements is not a good note. It may be worth something as evidence of a contract in a court of law, but it is not a negotiable instrument, surrounded by the safeguards which the laws and the courts have created for such instruments. The note must be a promise for the payment of money. A promise to pay something else is not a note within the meaning of commercial law. The note must provide for payment at a specified time, which can be ascertained with certainty. A note that is uncertain in this respect, as provision for payment upon the death or marriage of another, or upon some combination of circumstances, is not a good note. The payment, moreover, must not be promised conditionally, but absolutely at the time, and for the amount, specified. Commercial notes are surrounded by certain safeguards of law, because it is desirable that they shall be easily transferable. It is largely for this reason that an endorsement upon a note binds the endorser, if there is no obvious evidence of bad faith upon the face of the transaction, when it is held by an innocent third party. To require the holder of a note to make

inquiry as to the consideration for the endorsements, would destroy its value as a transferable instrument and greatly fetter business transactions.

This statement of the character of a note will make it clear how persons unfamiliar with business are sometimes swindled by accepting notes that bring in outside matters, depriving them of their certainty of payment, and making them void as commercial paper.

An illustration of a note of this character is here shown. This note does not provide for absolute payment at a date named, but only upon some contingency which it would not be in the power of a third

$ 10.00 Evansville, Ind., July 12, 1900

Sixty days after date I promise to pay

to the order of Benjamin Small, Agent

Ten Dollars

100

at in case such amount has been collected as commission upon sales

Value Received Hezekiah Green

No. Due

party, taking the note in ordinary course of business, to ascertain. Such notes are not good legal documents, but they are sometimes given to persons ignorant of business methods, with objects more or less fraudulent. A person receiving a note should examine it carefully, to see if it contains matter foreign to the promise to pay money at a fixed date and place, and without condition.

## THE ELEMENTS OF MONEY AND BANKING

It is important to every young man or woman to have some knowledge of the mechanism by which business is done, and of certain rules and practices which touch all phases of business life. Among these are the functions of money, the principles of banking, the manner of doing business with banks and trust companies, and the methods of dealing in securities.

The character and functions of money have been the subject of much controversy, but, among careful students, there is to-day very general agreement upon the fundamental principles of monetary science. Metallic money is a commodity, as is wheat, or clothes, or shoes. When industry began to be specialized,—that is, when one man devoted his whole time to producing a single class of articles,—exchange became necessary. But barter, which is the direct exchange of what one man produces for what another man produces, involved many difficulties.

One man who made woolen shirts might desire a pair of oars, but the boat-builder might already possess a sufficient supply of woolen shirts. The fact that another man who made bows and arrows wanted woolen shirts would not help the matter much for the man who wanted the oars. These conditions introduced such complications into exchanges, that by degrees people came to accept in exchange for their own goods those articles which were most generally desired, in the hope of exchanging these most desired articles for anything else which they might happen to want. The most desired articles became a sort of intermediary between all other articles, because they could most easily be exchanged for all others.

The metals gradually took their place ahead of other articles as the intermediary in exchange, because they represented large value in small compass, did not involve expense for keeping, like cattle or sheep, which were at first used for money among agricultural tribes, and did not lose their qualities by the lapse of time. Silver and gold in time came to take the place of other metals among the more advanced nations, because they combined in the highest degree the qualities already mentioned, and were most convenient for transportation from place to place. If gold has superseded silver among the richest nations, it is chiefly for this reason,—that a given quantity can be put in a smaller place, can be transported for less money, and represents the article most eagerly sought by all men. It is for these reasons the most economical and the most efficient money in a wealthy society.

This explanation of the origin of money is reduced to its simplest elements, and naturally suits many of the steps in the slow process of evolution by which production by each man for all his needs gave place to the complex organization of modern industry, in which each man produces everything for exchange, and almost nothing for his own immediate use. The fundamental principle in regard to money is that it is a commodity, like other articles whose value rests upon the demand for it in relation to the supply. Fashion or law may modify in some respects the demand, and therefore affect the value of money, but law does not often prevail over the natural tendencies

of men to use what is most convenient and efficient as a tool for doing any sort of work. Silver and gold are the most efficient tools for making exchanges, and they cannot well be superseded by artificial efforts to impress their qualities upon paper or something else which does not possess them.

Silver and gold are useful chiefly as an intermediary between other things. These other things are largely articles which render direct service,— food for the stomach, clothes for the body, houses for shelter. Silver and gold have uses for ornamentation, but their use as money is as an implement for exchanging other things. There is need only for a sufficient supply of implements for such exchanges. Piling up the implements needlessly would be equivalent to piling up threshing machines where there were already enough for the work to be done, or like duplicating the supply of railway cars when those already available carried all the freight. The piling up of great quantities of silver and gold would not add to the world's real wealth. This principle was understood even among the ancients, who portrayed it by the fable of Midas, who desired that everything he touched might turn to gold. His prayer was granted, and he died in agony because the food which was served to him turned to gold at his touch, and even the water with which he sought to slake his thirst, turned into a solid golden mass when it passed his lips.

The moral of this fable is the modest part played by money in the transactions of daily life. There is need for enough money to carry on business, but an excess beyond this amount is only waste. What people really mean when they say they want more money, is that they want more wealth,— more houses to rent, goods to sell, stocks from which to draw dividends; that they may in turn acquire for themselves, not great stacks of metal, but more of other things that they desire,— fine dinners, good wines, handsome clothes, beautiful pictures, and valuable books. There is hardly a limit in human nature to the demand for these things, but this desire should not be confused with the desire for money. The reason for the confusion is that the possession of more money means for the individual command over more of other things, while the supply of money in the world remains the same; but if every individual had his supply of money doubled by the doubling of the world's supply, he would be no better off than before. He would find that every one who had anything to sell was asking twice as much as before. The process of readjustment to new conditions, if the supply of money were doubled, would enrich some and injure others, but it would enrich most those who were the sharpest speculators upon uncertain conditions and upon the ignorance or honesty of their fellow men.

It has been said that the law cannot give value to paper as money. A paper promise to pay money can be made acceptable, however, with or without law, if people can be convinced that the promise is to be kept. It is such promises to pay money on demand, made by people who are able to fulfill their promises, that contribute a large share to the convenience of modern business transactions. Under this head, come the manifold developments of the modern banking system. It is essential to the young man and woman who go forth to battle with life, that they should understand how this system originated, why it exists, and how it contributes to carry on the great mass of transactions which make up the business of to-day. A knowledge of banking methods is as necessary for the business woman as for the business man. It is necessary for any woman who has a money allowance of sufficient dignity to permit her to keep a bank account, and it may be valuable even for the woman who has relied upon her male friends in such matters, in case she should be suddenly thrown upon her own resources.

A true knowledge of banking rules, and the reason for their existence, is best obtained by a preliminary study of the purposes and functions of banking. These functions are a natural evolution from the use of money. Banks were born of the needs of business, and their functions have extended with the growth and the volume of business, and with its extension over new fields. Banks are as necessary to the conduct of modern business as is the water supply or the gas or electric lighting plant to the modern town. Every one in the community, even the man who has no direct business with banks, benefits by the extension of banking, because of the stimulus which it gives to all forms of business. Manufacturing would come to a halt if the manufacturer could not get his notes discounted and borrow currency from the bank to pay wages to his men. Money could not be transmitted from one city to another except at heavy cost, and savings could not be put at the command of those capable of turning them to use. A bank provides circulation and vitality to the business community, much as the heart and veins provide circulation and vitality for the human body.

A bank is created to perform for manufacturers, merchants, and all members of the community, a special service in supplying money when it is needed, in taking care of it when it is not needed, in prompting the economical and efficient use of money, and in increasing its power through credit. The loans made by commercial banks

are not generally loans to help people who need money for personal expenses. They are loans made in connection with business transactions. A manufacturer, for instance, starts out in business with a capital of $50,000. He buys raw material to the value of $30,000. He then has a fund of $20,000 with which to pay wages while working his raw materials into goods. When this money is exhausted, if he could not get help from the bank, he would be compelled to suspend operations and to wait until his goods were sold and paid for. When he sells his goods to a jobber or retailer, however, he finds the latter anxious to get an extension of time for payment until he, in his turn, has sold the goods to the final purchaser. If there were no banking systems to aid him, the manufacturer would be compelled to refuse this accommodation or to suspend work, leaving his employees idle until he received some money and was able again to purchase raw material and to pay wages. The bank, however, is willing to advance money to him upon the note of the jobber or retailer to whom he has sold the goods. The bank has a store of money for this purpose, which has been intrusted to it by depositors, and it also has the power to issue its own credit in the form of bank notes. When the manufacturer, therefore, presents the note of the jobber to the bank, the bank is willing for a small compensation to lend to the manufacturer the money needed to keep on buying his raw material and to pay his wages until the note is due. The note is given by the jobber or retailer, payable on a certain date, usually not longer than three months after the sale. The jobber or retailer, as the result of his sales, has the money when the note comes due. He receives notice from the bank that the bank holds the note, or he may receive this notice from another bank in his own city, to which the note has been sent for collection. If he is unable for any reason to pay the note, the man who sent it to the bank, the manufacturer, is bound to make it good. Thus the bank has a promise of at least two business men to pay the money when it is due. By this means, the entire mechanism of production, and the buying and selling of goods, is kept in steady operation instead of being subjected to a series of "fits and starts" through the delays which the manufacturer or merchant would otherwise suffer in turning their goods at once into money.

The operation of the banking system in aiding the community in business transactions will perhaps be made clearer by taking the case of the country storekeeper. He usually trusts the farmer for goods until the latter's crops are harvested; and this he could not do unless he was able, in turn, to secure credit. So he says to his farmer purchasers, "Give me your notes for three or four months, to come due when the crop is sold. I will take the notes to the bank, and with

your name and my name on them, I can get money to make my purchases in New Orleans or New York. If it was not for the bank, I could not trust you, for I could not keep up my line of goods without making you pay cash. The bank here helps me in getting money for your notes, and the bank in New York helps the people of whom I buy the goods to give me credit." Thus, the banking system bridges over periods of scarcity between crops. The farmer, instead of waiting until he has sold his crops for cash, obtains seed and tools when he needs them. He is trusted for them, or gives his notes to be paid later. The storekeeper, in his turn, instead of waiting until the farmer has cash with which to pay for his purchases, sells seed and tools to him at the proper time, and takes a note which is as good as cash at the bank. It is obvious that the abolition of the bank, or the suspension of its functions, would throw the community into the same state of paralysis as would the cutting off the water supply or the lighting service.

The question may be asked whether it is wise to encourage the lending of money and the use of credit,—whether the farmer and the manufacturer ought not to earn their money before spending it? The answer to this question is that the wisdom of the loan depends upon its use. The lending of money to a spendthrift, who is living beyond his income, is what is called in political economy a consumptive or non-productive loan. It was because many loans prior to the organization of modern machine industry were of this character that the Catholic Church discouraged money lending and denied the legitimacy of interest, leaving the banking business of the Middle Ages in the hands of the Jews. All lending at interest was called usury. But the growing needs of commerce found a way for getting around even the mandates of the church. As it was admittedly proper to make a charge for the transportation of money, a system of fictitious bills of exchange, drawn in one place upon another, was devised, and the charge for the transfer was made large enough to cover a liberal interest rate. As in many cases the transfer of the money never took place, bills of this character, which were only the cover for a direct loan, came to be called "dry exchange." Thus the wedge was driven deep into the wall of the old prohibition against interest, because business loans had come to be productive. This is the basis of modern banking,—that nearly all the loans made are for industrial purposes. The money is put to uses which return it again with a profit, instead of swallowing it up for non-productive purposes. When this use of money came to be the rule and not the exception, the church gradually relaxed the rules against usury. Between 1822 and 1838 these rules became a dead letter in consequence of several

decisions of the Holy See, that, pending a final reconsideration of the whole matter, confessors must not harass their penitents on the score of the sin of usury.

It is possible for large business houses to do their own banking, to some extent, and this is what was done in the beginning of organized industry. The first bankers were the jewelers and goldsmiths. They were capable of judging better than anybody else regarding the quality of coin and metal brought to them, and they had vaults for its safe keeping. They gradually discovered that they could afford, without risk, to lend a part of the large sums intrusted to them, because all of them would not be called for by their owners at one time. There was some distrust of the new system at first, and Sir Dudley North, an eminent English economist of the seventeenth century, expressed great disgust at being followed about the exchange by goldsmiths, who begged to have the honor of serving him. When his friends asked him where he kept his cash, he answered tartly: "Where should I keep it but in my own house?"

The goldsmiths who were most successful in attracting deposits, gradually made this the chief part of their business. Then it was found that instead of lending gold and silver it was more convenient for them to issue a note entitling the holder to gold and silver if he desired it. It was in the nature of a transfer order, but passed freely from hand to hand and became the basis of the modern bank note. The first bank notes of this character were not printed in full, like the bank notes of to-day, but were partly written, like the modern check. It was found that when the notes were issued by a firm of well-known character, they were generally accepted as readily as money would be, and were not presented for payment in coin except in final settlements, or for sending the coin abroad. In many cases, the holder of a note would himself deposit it with the banker to his own credit. The banker would then cancel the note, and by this operation extinguish the original debt, but would create a new debt to the depositor by entering the deposit on his books.

The simple explanation of the origin of banking indicates some of its benefits to the community. The use of money was economized, and such money as there was, was made more useful to the community. This latter result was due to the fact that money was no longer locked up in strong boxes, as Sir Dudley North kept his, but could be loaned to men who were sending ships to India, building mills, and employing labor. Thus the money, instead of lying idle, was put to its greatest use. Being put to use, it was possible to make a charge for its use, which is called interest. It became possible, also, by means of branch banks, to send the money from places where

there was more of it than was needed to communities where there was not as much as was needed. In Scotland, branch banks were sometimes established in poor districts, with the view of obtaining a future profit from the prosperity which it was known the bank would introduce.

Having given this brief explanation of the origin and purpose of money and banking systems, it will be well to describe the kinds of money in use in the United States, with the circumstances in which they originated, and the distinctions between their character and use.

The basis of the American money system is gold coin. This has been the case since January, 1, 1879, when the government began paying gold for its paper notes. The law was somewhat doubtful, in language, however, until the act known as the Gold Standard law was passed by Congress on March 14, 1900. This law declared:—

> "That the dollar consisting of twenty-five and eight-tenths grains of gold, nine-tenths fine, as established by section 351, of the Revised Statutes of the United States, shall be the standard unit of value, and all forms of money issued or coined by the United States shall be maintained at a parity of value with this standard, and it shall be the duty of the Secretary of the Treasury to maintain such parity."

The meaning of this law, with the other sections which carry it into force, is that the money of the United States shall always be kept equal to gold. This was not the case from 1862 to 1879. It was thought necessary during the Civil War for the government to issue paper money, which was not to be redeemed until after the war. Such money would not be accepted as equal to gold, because it could not be exchanged for gold. The people who had gold, therefore, refused to part with it except for a larger amount of paper. The paper changed greatly in value from time to time. The influences which governed its value were partly the quantity which might be in circulation, and partly the probability that it would be paid some time in gold. This probability was increased or decreased in the public mind according to the victories or defeats of the Northern armies. The use of paper in this way, depending upon a promise of redemption whose fulfillment was uncertain, resulted in great changes in prices, and made business transactions uncertain. When the war was over, therefore, and it was no longer necessary to spend so much money for the army and navy, measures were taken from time to time to bring the paper money back to its value in gold. Its value rose from year to year, and an act was passed in 1875 providing for getting together a gold fund in the Treasury and for the payment of gold for paper on, and after, January 1, 1879. The result was that paper came nearer and nearer to gold in value until a few days before the New Year of 1879, when there was no longer any difference between them.

Gold, therefore, is the standard of value of American money. But there are not less than eight other kinds of money in use in the United States. What these kinds are and the amounts in circulation, and in the Treasury, on November 1, 1900, may be learned from the following table:—

MONEY IN THE UNITED STATES, NOV. 1, 1900—HELD IN TREASURY AS ASSETS OF THE GOVERNMENT

| KIND OF MONEY | HELD IN TREASURY AS ASSETS OF THE GOVERNMENT | MONEY IN CIRCULATION |
|---|---|---|
| Gold Coin (including bullion in Treasury) | $242,670,175 | $621,761,263 |
| Gold Certificates | ........ | 215,595,969 |
| Standard Silver Dollars | 5,220,948 | 73,479,469 |
| Silver Certificates | ........ | 421,380,745 |
| Subsidiary Silver | 5,641,098 | 81,035,187 |
| Treasury Notes of 1890 | 84,540 | 65,478,460 |
| United States Notes | 11,605,955 | 333,295,061 |
| Currency Certificates, Act of June 8, 1872 | ....... | 1,780,000 |
| National Bank Notes | 6,318,390 | 325,375,258 |
| TOTAL | $271,541,106 | $2,139,181,412 |

This table shows that gold coin and bullion make up nearly half of the money supply of the United States. The total amount of gold is obtained by adding together the gold coin in the Treasury, the gold coin in circulation, and the gold certificates, making $1,080,027,-407. The gold certificates are issued only against deposits of gold coin in the Treasury. The coin is not stated in the table, in order to avoid duplication, since the coin cannot be paid out while the certificates are in circulation. About $450,000,000, or more than forty per cent. of the gold, is actually held in the Treasury. Examination of the bank reports for September 5, 1900, shows that additional gold to the amount of $197,140,172 was then in the vaults of the national banks, without counting what may have been in state and private banks. Gold coin does not circulate freely in ordinary business. The American people have become accustomed to paper money, and they consider it more convenient to carry large amounts in paper than in gold. The gold certificates were issued for this reason. They entitle their holder to the amount of gold promised by the certificate. The lowest denomination of gold certificates is $20. They do not find their way largely into general circulation, but large certificates, for

$1,000, or more, are much used by the New York banks in settlements with each other and with the branch of the United States Treasury in New York. A large part of the gold money in the country remains in the Treasury and in the banks, as a guaranty of their ability to pay gold when required.

The standard silver dollars were coined under two laws of 1878 and 1890, requiring the Treasury to make purchases of silver bullion for this purpose. It was thought by the supporters of the gold standard that these regular purchases of silver by the government — amounting to a minimum of two million ounces per month under the law of 1878, and to $4,500,000 per month under the law of 1890 — were introducing into the circulation too large an element of silver in proportion to gold. A law was accordingly passed November 1, 1893, suspending further purchases of silver, and none is now coined (1901) except the remnants of what was then on hand.

The silver certificates are like the gold certificates, — representatives of the coin, which entitle the holder to coin if he desires it. The subsidiary silver consists of the dimes, quarters, and halves, which are used for small change. They are coined out of bullion purchased by the Treasury, and the entire amount in the country is limited, by the law of 1900, to $100,000,000.

The Treasury notes of 1890 were issued in purchase of silver bullion, and the whole amount issued was $155,931,002. They were redeemable, like silver certificates, in silver dollars, but they have been canceled when redeemed in this way. This has greatly reduced the amount outstanding, and the law of March 14, 1900, directed that they should all be retired and canceled when received into the Treasury. The silver dollars for which they are exchanged take their place in the circulation, and these silver dollars may be deposited in the Treasury in exchange for silver certificates. The entire process is for the purpose of simplifying the currency and having only one form of paper secured by silver, instead of two forms.

The United States notes are the paper money which was issued to carry on the Civil War. The amount authorized was $450,000,000. Congress directed their gradual retirement by a law of 1866, but later laws forbade the Secretary of the Treasury to retire more of them, and directed him to pay them out and to keep them in circulation whenever they were received into the Treasury. The amount outstanding, when the last law of this sort was passed in 1878, was $346,681,016, and at this amount they have since remained.

The currency certificates are simply the evidence that United States notes have been deposited in the Treasury for safe keeping. These certificates were issued for the convenience of the banks in dealing

with large amounts of money. Their issue was suspended by the act of March 14, 1900, and they will soon disappear from circulation.

The national bank notes are issued by the banks, and a full description of their character is more complicated than that of some of the other forms of money. Bank-notes are issued in most countries upon the general credit of the banks. The safeguards required are usually that the bank shall keep a certain percentage of its outstanding notes covered by coin, and that the remainder shall be secured by its general resources. This has been found to be a safe system in European countries, because the notes are issued there in most cases by a single large bank, which does the entire banking business of the country so far as the issuing of notes is concerned. Such banks are the Bank of France, the Imperial Bank of Germany, the Austro-Hungarian Bank, and the Imperial Bank of Russia. The Bank of France, on October 25, 1900, had 4,022,608,955 francs ($800,000,000) in notes in circulation and a gold reserve of 2,292,888,026 francs ($440,000,000).

A different system of security for the notes was, for a variety of reasons, adopted in the United States. The United States has no bank possessing exclusive privileges, but permits any body of five citizens of good standing, and under certain prescribed rules, to found a national bank. This in itself affords some reason for requiring greater safeguards than would be necessary where there is only one bank, which is subject to the constant scrutiny of the banking and business community. The form of security adopted in the United States, however, was the outgrowth of the needs of the government in the Civil War. The government had to borrow great sums of money to carry on the war. The issue of paper money injured the credit of the nation, and it was difficult to sell at a proper price the bonds which were issued for the purpose of borrowing money. It was accordingly decided to make a market for the bonds, by authorizing banks to use them as security for the issue of circulating notes. The national banking system was established, with the privileges of note issue which it involved, for the purpose of inducing the banks to buy the bonds. The system did not at first prove very attractive to capitalists. A new and more effective plan was then adopted to compel purchases of the bonds and the issue of national bank notes. A tax of ten per cent. a year was laid upon the circulation of the existing banks that were chartered under state laws. The result of this tax was to drive the state banks to give up their circulation or to reorganize as national banks. They could not afford to pay ten per cent. a year for the privilege of keeping their notes in circulation, for this was much more than they could earn by lending them. They accordingly entered the national system in many

cases, the bonds were sold to them in large quantities, and the bank-notes were issued upon the bonds.

The notes were profitable when capital was scarce and the rates for money were high, and the bonds were selling for no more than their face value in paper money. When the war closed, however, the bonds rose rapidly in value, partly because of the better credit of the government, and partly because the rates of interest paid on the bonds were higher than could be earned with equal safety by lending money in other ways. This caused a premium on the bonds. That is, it became necessary to pay something more than $100 for a bond of $100 paying five or six per cent. interest. The bank was only authorized to issue notes upon the bond to the amount of ninety per cent. of its face value. If the bond went to a price of $134, as has actually occurred with some of the four-per-cent. bonds, the banker would have to invest this amount in gold, or money equal to gold, in order to get circulating notes to the amount of $90. He would, in other words, get notes to lend equal to only two-thirds of the money with which he bought the bonds, and which he might otherwise have lent directly. He got the interest on the bonds in addition to the amount earned by lending the notes, but the two amounts combined came for a time to be equal to little more than the amount which he could earn by lending the money directly, and sometimes to less than this amount. This led the banks to reduce their circulation until it fell as low as $125,000,000 in 1891.

Other bond issues led to the increase of the bank-note currency later on, but it was not until the act of March 14, 1900, that there was a considerable increase, within a short time, in the amount of notes issued. This law authorized the issue of notes to the full face value of the bonds, instead of ninety per cent., and authorized the issue of bonds paying only two per cent. interest. These bonds had the advantage that they could be bought at a premium which was very small, and therefore did not require a large investment of money above their face value. These provisions led to an increase of the bank-note circulation from $249,434,278 on March 1, 1900, to $328,335,973 on October 1, 1900.

The currency of the United States, therefore, consists of nine different forms of money: Two — the Treasury notes of 1890 and the currency certificates — are in process of rapid retirement. Two other kinds — the gold certificates and the silver certificates — are the paper representatives of metal. The remaining forms are gold coin, silver coin, subsidiary silver, United States Government notes, and national bank notes. It is doubtful if any greater simplification could be introduced into the currency, unless by the entire abolition of the

United States notes and the issue of national bank notes upon a form of security different from that now required. Many financiers and students have advocated this step, but it has encountered much opposition, and will not be adopted until it is well understood.

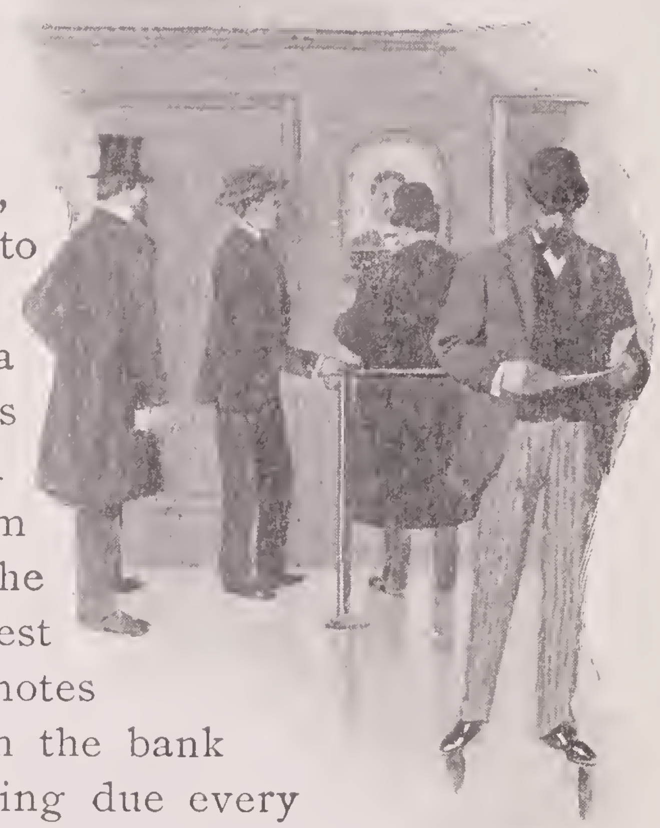
A bank-note differs from government paper money in the sense that it is a promise of the bank to pay money on the demand of the holder of the note. The money that is promised is, in most cases, silver or gold coin, but in the United States, it may be government paper money. The knowledge that a bank-note is only a certificate of indebtedness, and not strictly money in itself, may be important in a good many relations of life, as well as in the discussion of abstract monetary problems. It will at least prevent such a ludicrous mistake as was made by a crowd of Irish peasants, near the close of the last century, who sought to bring vengeance against the Beresford Bank in Dublin, because Mr. Beresford had been an active supporter of the British crown. They got together a lot of notes of the bank and made a bonfire of them, under the impression that they were burning up Mr. Beresford's money and bringing about the ruin of the bank. On the contrary, they were destroying the promises of the bank to pay money, and the bank was better off by every shilling of the notes thus destroyed.

The question: What constitutes legal tender? is often important in business transactions which become the subject of legal controversy. The law makes certain forms of money legal tender in payment of debt, and does not give this function to other forms of money. Gold coin, silver coin, and United States notes, are legal tender for debts. Gold and silver certificates, and national bank notes, are not legal tender between private individuals, although usually accepted in ordinary transactions. Subsidiary silver is legal tender only for amounts of \$10 A creditor may refuse to receive gold or silver certificates or bank-notes in payment of a debt, and the debtor would be obliged to prove that he had offered legal tender money in payment. What constitutes legal tender and what does not is of little importance in business transactions while all forms of money are equal to one another, but it would become of importance in case any discredit should be cast upon any form. This happened with the issue of government paper money during the Civil War, and out of it grew the legal tender cases, which were the subject of much controversy. There was grave doubt whether Congress had the power to impair the value of contracts, by making government paper money a tender where gold and silver coin had formerly been the only legal form of money. The Supreme Court finally decided, however, that the Government of the United States had the right to issue paper money and to make it a legal tender for all debts.

Having described the different forms of money in use in the United States, it remains to point out a function of banking which has become more important, in some respects, within the present generation, than the loaning of money or the issue of bank-notes. This is the use of credit. The function of a bank in making business transactions easy and convenient has already been referred to. This function consists chiefly in converting forms of credit which would not serve readily as substitutes for money, into forms which can be used for nearly all the purposes of coin or currency. When the manufacturer receives from the jobber or retailer a note in payment of the goods sold to him, that note is a form of credit. It is not a form, however, which the manufacturer can use readily as money. He cannot pay it to his hands in wages, partly because the note is not broken up into the proper sums, and partly because, even if it were thus broken up, employees could not readily pass such notes as money in buying their groceries and clothes at the shops. It is the business of the bank to take this note, which is a title to wealth, and to put it into a form which will make it useful. In the infancy of banking, the easiest way of doing this was by the issue of bank notes. The progress of popular education in the use of banks has gradually diminished the importance of the bank note and other forms of currency, and has increased the importance of bank accounts.

The great volume of obligations of banks does not consist in the notes they issue, but in the deposits which they hold. The two obligations are of substantially the same character. The difference consists in the fact that the man who has a deposit has a check-book, which contains blank notes upon the bank, which he can fill in at his pleasure, up to the limit of his deposit. It is a safer and more convenient form of credit in many respects than if the bank gave him its notes in return for his deposit of currency, or than the promissory notes of his customers. The bank makes its loans in the same way. When the officers consent to loan a man $10,000, they do not usually hand him the currency. They simply transfer to his credit on their books the amount loaned. If he needs the entire sum at once to make a single payment, he can draw a check which will entitle the person in whose favor it is drawn to take the money from the bank. But in the great majority of cases, he draws parts of the amount from time to time, as the necessity arises. His checks upon this account are offset, so far as the resources of the bank are concerned, by deposits from other people. It may even happen that the man in whose favor he draws his check will deposit it at the same bank. The result in that case will be that the net liabilities of the bank to depositors will not change, but the liabilities will be transferred from one patron to another.

The business of the banks is chiefly with business men engaged in manufacturing or selling goods. Their loans to such persons are usually secured by commercial paper, in the form of promises to pay definite amounts on set dates. There is another form of security, however, which has grown in importance in recent years. This is the deposit with the bank of transferable stocks and bonds issued by governments, railways, banks, and manufacturing corporations. In such cases, the bank can afford to be comparatively indifferent to the solvency of the borrower, because in case of his default, they have simply to sell the securities to protect themselves from loss. The principal item on the side of the assets of a bank, besides its cash reserve, consists of its loans and discounts. These are the notes of business men and the securities pledged for loans. It might seem at first that these are doubtful resources to form the chief wealth of the bank, but in fact, they are the best resource there is, except coin and currency. These notes are coming due every two or three months. When the bank has a considerable number of them, some are coming due every day. The bank loans only to men of character and good credit, so that it is able to rely upon a steady stream of money, or its equivalent, through the payment of these notes from day to day. This inflowing stream permits it to maintain an outflowing current in the form of new loans and advances. The business of this sort done by the national banks of the United States is classified as loans and discounts.



The term "discounts" refers especially to the notes of business men, from which the discount is deducted when they are accepted and the money is advanced by the bank. Discount is the charge made by the banks for putting money or its equivalent at the immediate command of the man who sells the note, while the bank awaits its maturity before being able to collect the amount from the maker of the note. Discount is a form of interest, but it is calculated in a slightly different way. In its origin, it is an outgrowth of the hostility of the early church to direct loans of money at interest. Sales of goods were made, to be paid for at some future date, and the seller would then make a discount for payment in cash. This natural trade arrangement, in the face of canonical prohibitions against interest, is one of the best proofs that men will not lend money, any more than any other article, without getting in return a part of its product. The system of discount adopted by banks is to calculate the interest on the principal amount to be discounted, and to deduct this amount from the principal.

The balance left by the deduction is then paid to the borrower or transferred to his credit. This method of calculation differs from the true discount by a small proportion, and adds to the profit of the bank.

The term «loans» is used loosely in the United States to cover all forms of money-lending by banks. So far as it is distinct from discounts, it refers to the loans which are secured by the pledge of stocks and bonds. Loans of this character are generally known in European banks by the name of «advances,» meaning that the money has been advanced upon a security which the owner can reclaim by repaying the money.

The remarkable feature of modern banking is the growth of the deposits intrusted to the care of the banks, and of the loans and discounts, while the issue of printed bank-notes has increased but little. The authority to issue bank-notes under favorable conditions is necessary in countries which are not well supplied with banks, these not having a large fund of surplus capital; but in the great centers of business, money and currency in printed form have come to play a small part in comparison with bank accounts, checks, and similar forms of credit. At the New York Clearing House, transactions amounting to $54,695,030,382 were settled in the year ending September 30, 1900, by the transfer between the banks of only $2,730,441,810 in various forms of currency. An illustration showing how rapidly loans and deposits have grown under the national banking system, in comparison with the issue of bank notes, is afforded in the table which follows. The table illustrates at the same time the remarkable growth of the national banking system since its foundation, and of the banking business of the country.

NATIONAL BANK STATISTICS

| Date | Loans and Discounts | Individual Deposits | Circulation Outstanding |
|---|---|---|---|
| January 4, 1864 | $ 10,666,095 | $ 19,450,492 | $ 30,155 |
| January 2, 1865 | 166,448,718 | 183,479,636 | 66,769,375 |
| January 22, 1870 | 688,875,203 | 546,236,881 | 292,838,935 |
| March 1, 1875 | 956,485,939 | 674,735,879 | 324,525,349 |
| February 21, 1880 | 974,295,360 | 848,926,599 | 320,303,874 |
| March 10, 1885 | 1,232,327,453 | 996,501,647 | 274,054,157 |
| February 28, 1890 | 1,844,978,433 | 1,479,986,027 | 123,862,282 |
| March 5, 1895 | 1,965,375,368 | 1,667,843,286 | 169,755,091 |
| February 28, 1896 | 1,966,211,736 | 1,648,092,868 | 187,217,372 |
| March 9, 1897 | 1,898,009,291 | 1,669,219,961 | 202,655,403 |
| February 18, 1898 | 2,152,171,680 | 1,982,660,933 | 184,106,322 |
| February 4, 1899 | 2,299,041,947 | 2,232,193,156 | 203,636,184 |
| February 13, 1900 | 2,481,579,945 | 2,481,847,033 | 204,912,546 |

The significant fact about these figures is the great increase in deposits in proportion to circulation. The first years shown in the table were those when the national banking system was getting a footing, and before it had absorbed most of the banking business of the country. The comparisons of the greatest significance are those of the last twenty years. It appears that within this time the bank-note circulation has actually decreased by one-third, while deposits have increased threefold The movement of the bank-note circulation is not a fair index of the quantity of currency in the country, because of the peculiar conditions under which bank-notes are issued. The amount of money in circulation, however, in the United States increased from $973,382,228 on July 1, 1880, to $2,139,181,412 on November 1, 1900. The growth of deposits in the national banks, therefore, has been threefold, while the increase in the money supply has been but little more than twofold. Credit has thus taken the place of money to a large extent, but the growing wealth of the country has enabled it to acquire such an increased supply of money as is needed for the convenience of transactions.

## KEEPING A BANK ACCOUNT

What has been explained in the preceding section regarding the kinds of money in use, and the mechanism and use of banking, affords a background against which can be sketched, more intelligently than would otherwise be the case, the every-day relations of the business and professional man and woman with banks. It is now proper to take up these every-day relations, and to show how to establish and keep a bank account, how to make deposits, to draw checks, and to transmit money to distant places. A study of these rules will prevent the ludicrous mistakes so often attributed by the humorous papers to women in their business relations. Two or three of these old anecdotes regarding women having business with banks will illustrate the popular opinion, which the business woman of to-day will be able to correct by a better knowledge of banking methods.

According to one of these stories, a young woman was presented by her father with a handsome bank deposit and a book of checks, as a Christmas present. She drew checks with great freedom, until she received a note from the teller of the bank asking her to call. He explained to her as delicately as possible that her account was overdrawn and should be made good. She paid the small balance, but seemed to think the fault lay with the bank rather than herself. "Don't let it happen again!" was the warning she gave the teller as

she caught up her perfumed skirts and moved majestically to the door.

Another young woman in a similar position could not be made to understand why she had overdrawn her account, when she had not used all the blank checks in her book. Still another, when notified that her account was overdrawn, is credited with having promptly made it good by drawing a check upon the same account.

There are several advantages in keeping a bank account, even when the amounts dealt in are not large. A bank does not desire to keep an account upon which a great many checks are drawn for amounts under one dollar, or for only two or three dollars; but banks outside of the Wall Street district of New York and other financial centers do not object to carrying a modest account, where checks for $10 and upward frequently appear. There is no objection in such cases to drawing checks occasionally for smaller amounts, which are to be sent by mail, or when there are special reasons for drawing them, but very small amounts should, when practicable, be paid in currency. The advice is sometimes given that the bank book shall be made a complete account of one's receipts and expenditures. It is hardly practicable to make it supersede the cash account, but if this is desired, all receipts, whether in currency or checks, should be deposited in the bank, and if currency is needed for small payments, the entire amount required for several such payments can be drawn upon a single check in favor of the owner of the account. The keeping of a bank account in itself tends to inform women as to business methods and the reasons for them. It leads to system and care in business transactions, and in giving one's signature to propositions which involve money.

Care should be taken in the choice of a bank to select one of old and established reputation, and one which pursues conservative methods of business. Inquiry among reputable men should result in proper information upon this point, but the inquiry should not be limited to a single person, since he might have an interest in some new and speculative bank, and therefore be biased in his judgment. There can be no benefit to the owner of a modest bank account in dealing with a bank that is engaged in promoting doubtful enterprises, or in taking large risks, however profitable its policies may appear to its directors and shareholders. A bank that goes out of its way to solicit deposits or to offer special inducements for them, is to be distrusted by a careful business woman. These statements apply strictly to commercial banks, which do not usually pay interest upon deposits,

and which allow deposits to be drawn by check without notice. There are other classes of banks, doing a proper and safe business, which pay interest when deposits are left with them for fixed terms. Their uses and benefits will be considered later. It is better in every-day transactions to employ a commercial bank which does not pay interest on deposits but which does not object to carrying a modest account. If a business woman has considerable sums of money, which she desires to keep in banks instead of investing in property or securities, she may properly keep these sums, which she is not likely to require for some months, in a savings bank or trust company, where interest will be paid, and, at the same time, keep a few hundred dollars, or a few thousands, according to the state of her fortune and the magnitude of her dealings, in commercial banks where she can increase or decrease the amount at pleasure.

What was said about banks in the preceding section relates largely to the national banks of the United States. The national banks enjoy some advantages in respect to security and standing over other banks, because they are incorporated under a law that enforces uniform rules throughout the United States. The mere fact that an institution is a national bank, even if it is a small one, in a remote locality, gives it a somewhat better and more definite standing in the financial centers than if it is only a state, or a private, bank. National banks cannot be organized with a less capital than $25,000, and could not be organized, previous to March 14, 1900, with a less capital than $50,000. State banks, in some of the states, on the other hand, may be organized with a capital as low as $5,000. While such a small bank may be carefully and safely conducted, there is a degree of security in size alone that is of some importance. A large bank is more likely to be conducted by men of large affairs and wide experience than is one whose owners and officers control only small sums of money. The element of age in a bank is also an important proof of its solidity. New banks are often founded by groups of wealthy capitalists, who attract large business through the influence of their names. This influence is legitimate, and these banks are often successful, but it should be borne in mind that prominent names are often used improperly by unscrupulous persons, and that the fact that a man of great wealth is a shareholder in a bank, does not place his fortune at the command of a bank in case of failure, except to the extent of the number of shares for which he has subscribed.

The security of state banks depends upon state laws, which cannot be set forth here in detail. Some of the states have excellent laws, and the state banks are among the strongest and most efficient of

their institutions. This is the case even in the City of New York, where there are also the strongest of the national banks. The other states where the state banks do a large volume of business are Pennsylvania, Virginia, Georgia, Kentucky, Ohio, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, Nebraska, Kansas, and California. The private banks are also numerous in the states of the middle West, but the majority are institutions of small capital. Upon the whole, therefore, the preference in choosing a depository for any considerable sum of money, should usually be given to a national bank.

There is some advantage in choosing a national bank for keeping one's account, even if it should prove no stronger than a state bank, and though both should fail under substantially the same conditions. The affairs of the national bank would be administered by Federal law, which in this respect has been reduced to a more exact science than have some of the state banking laws. It was ascertained by Comptroller Dawes, in 1898, that banks which had failed under the national banking system, from its foundation, had, upon the average, paid dividends of about 75 per cent. This is considerably more than the average dividends paid by state, and private, banks. Some current ideas regarding bank failures, however, are much exaggerated. The average ratio of losses by failure amount to less than one-quarter of one per cent. of the deposits of all the banks under the national system. A failure now and then occurs in which the depositors lose heavily, but in many cases their chief loss results from the inconvenience of being deprived of the use of their money while the affairs of the failed bank are being adjusted. While some banks have paid less than the average of 75 per cent. found by Comptroller Dawes, others that have failed have paid more, or have even paid all of their depositors in full. The capital of a bank and its surplus fund are a sort of guaranty for the payment of the deposits. It often happens that this fund is visited with loss to the shareholders of the bank, while the depositors escape with little loss or none.

It is prudent for a woman who has several hundreds, or thousands, of dollars on hand, to distribute her deposits among two or more banks, differing as much as possible in the character of their business, and, if practicable, in their location. The maintenance of a certain sum in a savings bank or trust company will prevent risking all one's eggs in one basket, because in case of failure of the bank where one's current account is kept, a draft can readily be made upon the funds in other institutions. Something regarding the resources of a bank may be ascertained from its balance sheet, showing the proportion of cash on hand and the ratio of capital and cash deposits. A bank is justified, in loaning as much of its resources as can be

invested with safety; the rules for determining the limit of safety, however, are so complicated, and differ so much under different conditions, that they cannot well be set forth here in detail. It may be stated as a general rule that greater care should be exercised in choosing a bank in the newer states, where banks are under stronger temptation to lend upon speculative enterprises, than in the older states, where commercial banking has been reduced to a more exact science, and where, in any case, business risks are less.

The first requisite for doing business with a bank is to be authorized to open an account. In order to have the account accepted, it is usually necessary to secure an introduction to some officer of the bank. Some American banks accept deposit accounts without introduction, or guarantees for the depositor, but they will not usually pay money without the identification of the person asking payment. The banks of Great Britain, and of other countries of Europe, are much more particular in accepting an account. They usually require a person to be introduced by a reputable patron, and to present satisfactory references. Any person of standing known to bank officers can present and identify a person desiring to open an account at an American bank, but presentation by some patron of the bank is usually more graceful than that secured through an outsider. After introduction, the person desiring to open the account is introduced to the receiving teller, who gives him a "pass book," on which are to be entered the amounts of his deposits. He is then introduced to the paying teller and requested to write his signature in the "Signature Book." This book is kept for reference for the purpose of comparing the signature with those on checks, in order to determine whether the latter are genuine or not. If the intending patron has brought money or checks with him to deposit, they are properly entered on his pass book, and he is then free to draw checks against the amount.

A check is a written order upon a bank, directing the payment of a sum of money to the person named in the check, from funds at the bank to the credit of the maker of the check. A person who opens a bank account should obtain at the bank some blank checks or a book of checks. A check-book is preferred by the systematic man and woman of business, because it enables them more conveniently to keep track of their dealings with the bank. The check-book, besides containing the blank checks, has ruled paper at the side of the checks which remains in the book when the check is torn out. The paper next to each check is known as the "stub." Upon it should be entered not only the amount of the checks drawn, but the deposits made. Some persons rely entirely upon the bank to keep their account, but it is much safer and more systematic to carefully enter deposits, to add

them to the amount previously on deposit, and to deduct the amount of the checks which are drawn. The account of the depositor will then correspond exactly with the account kept against him at the bank, if both are correct, except in the case of certain charges made by the bank for doing business. These charges are small, and when a settlement is made with the bank, the depositor can easily determine, even without getting the details of them, whether any serious mistake has been made in his account.

The cut on the adjoining page shows specimen checks drawn on the National City Bank of New York, now the largest bank in the United States, with entries of deposits on the stubs. The parts in script are those which are filled in by the maker of the check when he draws it for the purpose of making a payment or for obtaining money for his own use. The name of the person in whose favor the check is drawn should be plainly written, and in some cases his residence should be given. The signature should also be as plain as possible, especially when the check is likely to pass through other banks than that where the account is kept.

The signature adopted by a woman who has an account of her own should ordinarily be distinctive. The best form is to write her Christian name followed by her family name,—"Jane R. Smith," not "Mrs. Thomas A. Smith." The latter signature might be mistaken for "Mr. Thomas A. Smith." In order to avoid successful forgeries based upon the study of personal letters, it may be desirable for a person having a large deposit to arrange with her banker to sign checks in a slightly different form from that used in social correspondence, but this precaution is hardly necessary in the case of a modest deposit. When the check is in favor of a particular fund, the official relation to the fund of the person in whose favor it is drawn should usually appear, as "Pay to Henry R. Tompkins, City Treasurer." In this case, a check payable to Mr. Tompkins personally, could not be so readily proved to have been paid to him as could the former, and it might, in any event, require more labor on his part in order to transfer the amount to the proper fund. This is as far as the specifications regarding the destination of the proceeds of a check should be carried. Checks sometimes specify that they are "in full of my account," or they contain other qualifications which it is no part of the duty of a bank officer to pass upon. Such checks are a source of annoyance to bank officers, and are often, and very properly, refused.

Checks drawn in favor of third parties should set forth the name of the person or corporation in a form in which it is usually employed by them, unless the drawer of the check has information that a different form is required or preferred. The owner of a bank

92

*Brought forward* 20,682.87

1,171.09

19,511.78

52 WALL STREET

No. 92 New York, *November 10,* 1900.

**THE NATIONAL CITY BANK,**

Pay to the Order of *William Royer, City Treas.*

*Eleven hundred and seventy-one* $\frac{09}{100}$ Dollars.

$ *1,171.*$^{09}$

*The Emma Barton Endowment School,*
*by Clara Innis, Treas.*

93

*Balance* 400.00

50.00

350.00

52 WALL STREET

No. 93 New York, *November 18,* 1900.

**THE NATIONAL CITY BANK,**

Pay to the Order of *Self*

*Fifty* Dollars.

$ *50.*$^{00}$

*Jane R. Smith.*

account will often have occasion to draw money for his own use. In such cases he must fill out a check in substantially the same form as for a third party, and affix to it his signature. In filling in the name of the payee,— the person to whom the check is to be paid,— he has the choice of several forms. One of the best is to make the check payable to "self." This is a complete identification and the check cannot be paid to any other person. In adopting this form, he should cross out the words "to order of" so as to avoid the necessity of writing his endorsement in addition to his original signature. That is, the check should be made directly payable to "self" rather than "to order of self," as would be desirable if it were to be paid to the order of any other person. A check to bearer is usually written only when some trusty messenger is employed, and even then identification of the messenger is often required in American banks. The rule is different in English banking institutions, where the law authorizes the payment of a check to any person presenting it, without identification. A check to bearer should be written only just before its presentation at the bank, and it should not be employed where it is likely to pass through several hands. Such a check can be collected by any one into whose hands it falls, without such fraudulent writings or signatures as would be required if it were payable to the order of some particular person.

The amount for which the check is drawn should appear twice,— written in words and in figures. The wavering lines drawn before and after the amount of the check are for the purpose of preventing its being changed. If the check was simply for $50, and the entire space before the "Fifty" was left blank, it would be easy for a swindler to write in the words "One hundred and" and to pass the check in this form through innocent hands, or even to collect it at the bank on which it was drawn. This possibility of raised checks is guarded against by perforations, and in several other ways, where they are issued by banks or large business houses; but for the person with a modest bank account, ordinary caution in filling in the checks is likely to afford a sufficient safeguard.

Let us now take up the case of receiving a check in payment for some service rendered. An amusing, though somewhat apocryphal, story is told of William D. Howells, the eminent author, in regard to his first check.* He, not knowing what to do with it, asked a friend, and the friend took him to a bank and had an account

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*A note from the present writer to Mr. Howells regarding this story brought the response: "I am sorry, for your sake, to say that the story in question is mostly a joyous fake."

opened in favor of Mr. Howells. The author felt very proud that he had a bank account, but presently it occurred to him that he would like to make some use of the money. He sought his friend again, and rather sheepishly inquired: "After you've got money into a bank, how do you get it out again?" It has already been explained how money is drawn from the bank by means of checks. It remains to set forth, however, what to do when one receives a check. The process is simple, but has several variations. If it is desired to use the money at once, and an account is already established at the bank, it is only necessary to endorse the check, and to present it to the paying teller. He may hand over the amount at once, if he is satisfied of the value of the check, and with the soundness of the person's account who presents it. A bank has a right, however, to refuse to pay a check until it has been collected. That is, if it is drawn upon a deposit in a Boston bank and is presented to a New York bank, the latter has the right to take time to send the check to the Boston bank for payment before advancing money for it. This right is likely to be exercised against a person with a small account, especially if he presents an unusually large check, or in case the check is drawn upon a bank at a considerable distance. In such a case, all that the owner of a check can do is to wait the necessary time for it to be sent to the issuing bank, or perhaps to a center where checks are cleared, and for notice to come back to the bank that the check has been accepted and paid. The owner of the check is entitled to ask a receipt for it from the teller of the bank where he leaves it for collection.

The simpler method, in case one already has a deposit account, and when there is any doubt of having the check paid in cash at once by the teller, is to deposit it to one's credit. This is done by endorsing it, and filling out a slip, stating the amount and the name of the person making the deposit and presenting it to the receiving teller. He enters the deposit on the pass book and the depositor is enabled to draw against it when he thinks a sufficient time has passed for its collection. If he has other funds in the bank sufficient to cover his current drafts, he will not be compelled to give any further thought to whether the check has been collected or not. He will be promptly notified in case there is any failure to collect the check, or any irregularity connected with it, but in dealing with reputable people, the chances are small that any such irregularity will occur.

Clerical errors are sometimes made in filling out checks, which leave them incomplete or inconsistent. The latter occurs when the amount written in words, called "the body of the check," differs from that in figures. In such cases, the rule of law is to pay the amount

in the body of the check, rather than that expressed in figures. Many banks make it a rule to pay only the smaller amount, whether expressed in figures or fully written out. If the difference between the two is considerable, it is best to return the check to its maker for correction, without even presenting it to the bank.

A point of law which it is well to bear in mind is that checks should be presented at once for collection in order to hold the parties. The maker of a check is liable for the amount at any time, if his position has not been changed by bankruptcy or some other legal event, but if the presentation of the check is unduly delayed, he may have overdrawn or closed his account, putting the holder of the check to much trouble to make recovery. The bank, in closing the account, would have no knowledge of outstanding checks which were not certified. An endorser, moreover, who might be held for the check if it was presented promptly, is not liable if there is negligence in notifying him that he is to be held. No difficulty of this sort is likely to arise in legitimate transactions with persons who are trustworthy, but a check may sometimes fail of payment because the maker does not keep an accurate record of his account with the bank and has carelessly overdrawn it. Some persons and corporations in transmitting checks make the request that they be deposited for collection at once. This is in order that their account may correspond with the record of the bank, and may not be confused by the appearance of dilatory checks after they have asked for a statement of account from their banker.

The endorsement of a check usually consists in writing upon its back, by the last holder, a name or words which will transfer it to another. A check may pass through several hands before being presented for collection to the bank upon which it is drawn, but it finally returns to this bank and is paid, if there is sufficient money to the credit of the person who drew it. The endorsement may be either "in blank" or "to order." An endorsement in blank is made by simply writing the name of the last holder upon the back. The name should be written across the back of the check sufficiently far from the end so that it cannot be torn off without mutilating the check, but so as to allow reasonable room for additional endorsements. An endorsement in blank is less safe than endorsement to order, because a check endorsed in blank may be endorsed and collected by any person into whose hands it falls. An endorsement to order is a direction to "pay to the order of ——————." This requires the signature of the person named in the endorsement and his identification if he undertakes the collection of the check. Endorsement in blank is usually sufficient in depositing checks for collection with

a bank, but endorsement to order is safer if the check is to be transmitted by mail or through several hands. Endorsement may be limited by such instruction as "for deposit only." Such a direction relieves the bank from obligation to meet protest in case the check cannot be collected. While protest may be desirable in some cases, it involves formalities and expenses which the owner of the check may prefer to avoid, if satisfied that such proceedings will accomplish nothing toward recovering the amount of the check.

The pass book which the depositor holds should be left with the bank every now and then to be settled. The bookkeeper will then enter all the checks which have been drawn (with the charges for their collection, if such charges are made), and will strike a balance between these debits against the depositor and the credits in his favor arising from the checks and money which he has deposited. If the depositor has kept his own account on the stubs of his check-book, he will then be able to make a comparison and to ascertain whether any error has been made by the bank or himself. While the chances of error by the bank are small, errors sometimes occur, and he should be equally frank in bringing them to the attention of the bank officers, whether they are made in his favor or against him. Most text-books for business men recommend the presentation of books for settlement every month, but several months may safely be allowed to pass if the account is small and the number of checks drawn is not large.

We have dealt thus far with a simple deposit account at a bank. But suppose one wishes to borrow from the bank. This cannot readily be done by small depositors upon their own account alone, except by pledging security. A man or a woman who owns a government bond, the bond of a first-class railway which is paying dividends, or some manufacturing stock of recognized value, can, by leaving the bond as security, obtain at least a part of its face value from the bank as a loan. The bank does not consider it necessary in such cases to call for any explanation of the borrower's means or of his ability to pay. The possession of even a small amount of such securities is, therefore, convenient in obtaining ready money. The money can be obtained temporarily without selling the security, and the security draws interest in favor of the owner while in the keeping of the bank. It is necessary, however, that securities offered for this purpose to a bank should be of a high character, and should be quoted on the stock exchanges. There are great quantities of worthless or doubtful mining stocks, and shares in undeveloped manufacturing enterprises, which would not be accepted by a well-conducted bank as security for a loan. Securities of this character sometimes

have real value, but are not much known outside of the locality where they are issued. If they are known by the banks in that locality to be valuable, such banks might in some cases make loans upon them, but well-conducted banks are cautious about making loans upon large amounts of local securities, where any doubt is involved of the success of the enterprises, and of their continued ability to pay interest or dividends.

The person who has not securities to intrust to the bank as the pledge for a loan, will find difficulty in borrowing except as a part of mercantile transactions. If he is engaged in manufacturing or selling goods, he may be able to obtain notes from those to whom he sells. Such notes may be accepted and discounted at the bank, if the bank is convinced of the honesty and good business judgment of the borrower, as well as those of the maker of the note. The borrower will be relied upon to make the note good in case the maker fails to do so. Loans of this character are not made in the United States on so small a scale and to such small traders as in Europe. The Bank of France accepts the notes of small merchants, running as low as $1 or $2. The Bank of France is not, however, the first judge in most of these cases of the value of the paper. It is accepted by private bankers or by the joint stock banks, whose agents know the standing of the merchants making the notes. These banks intrust the collection to the Bank of France, because that bank employs a large force of collectors or runners, who make the rounds of the shops, from day to day, presenting these notes for payment. The Bank of France looks to the bank that first accepts the paper to make it good in case of loss. The losses are few and small, however, and it might be beneficial to small merchants in the United States if such a system could be introduced here. In several European countries, loans are made by the banks to the farmers upon the security of a mutual guaranty. The farmers of a given locality will come together to form an association, the members of which will guarantee to the bank, payment of the loans made to the individual members. The association, of course, passes upon the amount which each of its members seeks to borrow from the bank, and exercises a rigid scrutiny of its own upon the business and integrity of its members. The Russian Government has established a general system for loans of this character to agricultural syndicates, which are doing much to develop the farming interests of the country, and the last charter of the Bank of France, granted in 1897, set aside a fund of about $3,000,000 for inaugurating a similar system of syndicate loans to farmers in France.

## TRUST COMPANIES AND SAVINGS BANKS

Trust companies have come to play a large part in modern finance, and will be found more useful, in many cases, to the woman who has property, than will be the commercial banks. She will probably need to use both institutions, but there are several things which will be done for her by the trust company that are not done by the banks. Trust companies are a development of the great variety of financial functions now imposed upon capitalists and financiers, as the result of the growing volume of money seeking investment, the great number of securities to be issued and distributed, and the many estates to be managed.

A trust company usually abstains in the main from the business of a commercial bank, both in respect to carrying active deposit accounts and in respect to making short-term loans. The two classes of business go together, because a bank which lends its money for short terms can easily recover it for the purpose of meeting drafts by depositors, while a bank which lends large sums for long terms is not in so good a position for meeting frequent demands upon running accounts by its customers. The trust company, therefore, usually pays interest upon deposits, and sometimes pays a higher rate for a deposit of a year or more than for one of six months or three months. Trust companies are required in New York to pay at least two per cent. on deposits, while commercial banks usually pay no interest except by special arrangement with large depositors. The trust company does not expect its depositors to draw frequently on their accounts. In some cases, a distinct agreement is made that the money shall be left with the company for a definite period, and a certificate of deposit is given rather than a check-book. The New York trust companies do not now impose formal restrictions upon their depositors as to the time of leaving their money on deposit, but they hold large amounts which they know are not likely to be called for. They do, practically, an ordinary banking business, issuing check-books which permit their depositors to draw when convenience requires. Trust companies, however, do not usually care for very "active" accounts, involving large daily transactions in checks.

The trust company usually carries but a small cash reserve in its own vaults, because there are not likely to be as many large and unexpected demands upon its cash as in the case of a commercial bank. A considerable part of its cash is often intrusted to a bank, either by agreement for the temporary use of the bank in its loans, or simply as a running account, like that of individual depositors. The depos-

itor in the trust company who desires to withdraw a part of his deposit is often paid in such cases by check upon the bank where the trust company keeps its cash. A check of this character does not require certification in ordinary cases, because the signature of the cashier of the trust company to the check carries as much weight as would the signature of the cashier of the bank to a certification. If certification of a trust company check is required, it must be obtained from the bank upon which the check is drawn. The trust company in that case is relegated to the position of an individual who goes to his banker for the certification.

The trust companies are regarded in some quarters as the rivals of the commercial banks. They are rivals within certain limits, where they accept running accounts and permit checks to be drawn upon them. They have many privileges under state law, particularly in the small amount of reserve required, which are not granted to commercial banks. It will presently appear, however, that most of their business is of a character which the banks could not assume in any event, and that they occupy a field which is exclusively their own. They aid the banks, to a certain extent, by making large deposits with them which otherwise would not probably be available at all. The trust companies are able to transfer to the banks, funds deposited with them on time, which, under the conditions imposed upon the trust companies, the banks could not accept directly from depositors. Thus the resources of the commercial banks for making loans are increased, and the whole amount of capital in the community is transferred into a form which makes it available for the business for which it is best adapted.

The essential purpose of trust companies is what their name implies,—to manage trusts. They receive money which is not likely to be put to immediate use by its owners, pay interest on it, and find uses for it. A woman having an independent fortune in money, for which she cannot find a safe investment, may deposit it with a trust company and draw interest upon it regularly, without reducing the principal and without giving herself any serious care in regard to it. The objection to doing this upon a large scale is the low rate of interest paid by trust companies. Other safe investments can usually be found which will pay four per cent., while the trust company may pay but two per cent. The trust company will be found useful as the temporary custodian of money which is awaiting investment. Instead of lying idle and earning no interest for several months, it will at least earn two per cent., and the owner will be enabled to feel that she can afford to spend more time looking about for a safe investment than if her money were earning nothing.

The services of trust companies go much beyond the receiving and lending of money. They are incorporated to perform all classes of trusts relating to business and financial operations. The management of estates is now falling largely into their hands and being taken away from individual trustees. There is an obvious advantage in this, because of the greater security derived from a strong corporation than from one or two individual trustees. The cases are so numerous in which men of high standing have proved recreant to trust and have swallowed up in speculation or fast living the savings of widows and orphans, that the advantage of having the guaranty of a great corporation behind a trust is obvious. An officer of the corporation may steal or speculate, but this will not impair the obligation of the corporation upon the trusts which have been confided to it. Only in case the stealings go so far as to eat up the capital and surplus of the trust company and to drive it into bankruptcy, is there risk of loss by the persons intrusting commissions to its care. It is desirable that the prudent man or woman should study carefully the reputations of the companies to which they intrust their means, and that if they own large amounts of securities they should insist on the verification of the securities from time to time; but as between the individual trustee, however eminent, and a reputable corporation, the corporation is greatly to be preferred.

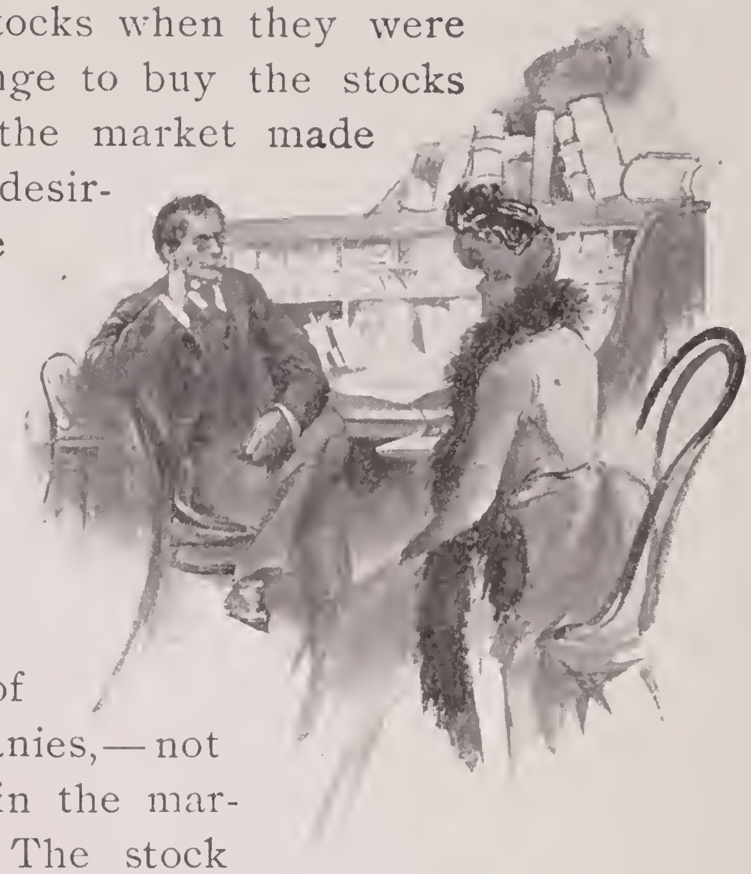
If any class of persons is suffering seriously from the competition of the trust companies, it is probably the individual attorney, rather than the commercial bank. Many of those important functions heretofore intrusted to the attorney, in executing wills, distributing estates, transferring real estate, and acting as trustee, in money matters, for minor children, are now assumed by trust companies, and are carried out according to an organized system. The trust company has other advantages besides its greater safety. Doing business to some extent upon a wholesale rather than upon a retail plan, and having officers and clerks each devoted to some specialty, it is able to perform given services with greater promptness and efficiency, and at lower cost. It has a recognized standing in banking and business circles, which permits negotiations in regard to securities and money matters to be carried on, without presenting guaranty of responsibility on each separate occasion, thereby saving time and expense. The corporation, moreover, is a permanent body, subject to the limitations of state laws. Sickness and incapacity do not, as often happens with the individual trustee, prevent an ordinary performance of its functions. It is not surprising, therefore, that the trust companies have lately been encroaching much upon the field of the attorneys, and that their business and methods are unpopular with some members of the legal profession.

A deposit with a trust company may be opened in substantially the same manner as with a commercial bank. An introduction may be obtained from some responsible friend or some patron of the bank, but an introduction by an outsider may be dispensed with, if a deposit is to be made and not drawn against for some time. The trust company is less under the necessity of guarding against fraudulent checks than is the bank, because it handles comparatively few checks. The certificate of deposit is a substitute for the pass book given by the commercial bank. Care should be taken in the custody of a certificate of deposit, but the trust company will exercise at least the usual precautions against paying money upon a certificate which has been lost or stolen. Some of these certificates of deposits contain blank receipts on the back, which are filled in for the amount drawn, when only parts of the deposit are drawn, and signed by the depositor. A receipt is also required in the company's book, in order to guard against the claims which might be set up in case of the loss or erasure of the certificate.

A certificate of deposit is not always the most convenient form of acknowledgment from a trust company. The owner of it is put to more inconvenience if he loses it, than if he simply has an account, in his favor and an ordinary pass book. "Time" certificates of deposit were formerly issued in some cases, which provided for leaving the money with the bank for a fixed term, as six months or two years. The issue of such certificates has been practically abandoned since the passage of the law of June 13, 1898, imposing a stamp tax of two cents for each $100 on any "certificate of deposit, drawing interest, or order for the payment of any sum of money, otherwise than at sight or on demand." As this charge would amount to as much as $2 on a certificate for $10,000, and as most of the banks are willing to pay the money of their depositors on demand, most of the certificates now issued are demand certificates and do not fall under the heavy rate of taxation just named.

One of the duties which may be profitably confided to a trust company, by a woman who does not deal largely in stock exchange securities through brokers, is the buying and selling of her securiities. The trust company has its own broker, who is likely to be more trustworthy than some who might be brought to the attention of the individual investor, and is likely to be honest with the trust company, even in cases where he might not be honest with individuals. If a woman holding government bonds, for instance, desired to sell them, and to buy railway stock, she could request the company to make the transaction for her. They would follow her instructions, either to do it at once, without regard to the prices, or to sell the

bonds when they were high and to buy the stocks when they were low. If requested, they would doubtless arrange to buy the stocks before selling the bonds, if the conditions of the market made such a transaction more profitable. A woman desiring to speculate would probably find it more convenient to put herself in direct communication with a broker, but for limited transactions for investment, the trust company could be counted upon to perform the transactions with safety and honesty, and to relieve the investor from all inquiry and worry as to the business details.



This matter of dealing in securities is one of the most important functions of trust companies,—not so much buying and selling from day to day in the market as in the financing of new enterprises. The stock and bonds of a new corporation are often placed in the custody of a trust company pending their distribution. Money received in large amounts while reorganization plans are being carried out is safely disposed of in the same manner. These transactions were formerly intrusted to individual attorneys, who were usually of high standing, but the guaranty of the trust company gives greater certainty of safety and sound business methods than do those of any individual. Trust companies thus far have been confined chiefly to the Northeastern States. There were 290 reporting to the Comptroller of the Currency in 1900, of which 269 were north of the Potomac and east of Ohio. New York had 59, with aggregate capital of $48,250,000, and Pennsylvania 97, with aggregate capital of $39,809,778. Massachusetts, Rhode Island, New Jersey, and the District of Columbia, are the other Eastern communities having the strongest trust companies, but there are several in Minnesota, Indiana, and Kentucky. The combined capital of the trust companies in the United States in 1900 was $126,930,845, and their total resources were $1,330,160,343. The banks of the states northeast of the Potomac had all but $11,405,419 of those resources and all but $4,666,532 of the deposits, which amounted in all to $1,028,232,407.

## SAFE DEPOSIT COMPANIES

Another class of institutions, somewhat related to banking, but doing a business like that of the old goldsmiths, in guarding valuables, is the safe deposit company. Safe deposit vaults are often conducted by loan and trust companies as an incident of their busi-

ness, but some of them are entirely independent of other forms of banking. A safe deposit company is the incorporated custodian of valuables. It keeps vaults for the express purpose of storing such valuables of all classes,— legal documents, jewelry, plate, and even clothing and furniture. Such boxes vary in price, according to their size and to the location of the company. A small box, capable of holding a few deeds, bonds, and other important documents, can be rented by the year for $3 or $5, but a higher rate may be charged in a locality where real estate rentals are high. Larger boxes cost more in proportion, and many companies have separate buildings, removed from the small boxes, where furniture may be stored and clothing be kept in cold storage.

The special benefit of a safe deposit company is the security which it affords. This is guarded by law in the larger states, where such companies are most numerous. Under the terms of the agreement which may be made with the depositor, they are liable for the entire value of the property deposited with them. Independently of legal liability, however, they take the precautions against loss by fire, and theft, which could not well be taken by the private individual, however large his resources. He might keep a strong box or a fire-proof safe, but the very existence of these safeguards would be a temptation and an invitation to thieves. The trust companies not only employ all the latest and most improved devices in locks, bolts, bars, and fire-proof walls, but they keep a body of trustworthy guards constantly on duty. A raid by thieves upon a safe deposit company would hardly be practicable. It would require the connivance of many employees, the blindness of the regular police, and the penetration of many time-locks and other safeguards, which even an employee cannot tamper with except at stated times, and under the scrutiny of others.

The process of hiring a box from a safe deposit company is simple and direct. An introduction from some responsible person is usually required, simply as evidence that the applicant is respectable, and has no sinister motives. The applicant receives a schedule of the charges for boxes of different sizes, and will be shown such boxes by the officials. Payment is usually made in advance, the address of the subscriber is taken, instructions are given in regard to obtaining admittance,— including, perhaps, an introduction to the officer in charge of the vaults,— and a key to the deposit boxes is furnished. These keys are of such form that a depositor cannot open his box without the coöperation of an officer of the company, and the officer of the company, on his part, cannot open it without the use of the key of the depositor. Passwords for admission are sometimes given, which should be kept a secret by the holder of the box.

## SAVINGS BANKS

The business woman can make profitable use of the savings banks, both for herself and for her children. These banks are convenient for many persons of small means, who may not find it necessary to keep an account in a commercial bank or to deal with a trust company. Savings banks in most of the larger states, particularly in the Northeast, are well protected against loss and unwise management by the state laws governing their creation and management. They are conducted largely in the interest of their depositors, being governed by trustees who do not expect to make money, as shareholders, from the business of the banks. This is the character of the savings banks of all the New England States, New York, New Jersey, Pennsylvania, Delaware, Maryland, West Virginia, Ohio, Indiana, and Wisconsin. There are stock savings banks in a number of Southern States and in Ohio, Minnesota, and Iowa. The bulk of the savings are in the mutual savings banks. Out of the total savings deposits in 1899 of $2,179,468,229, the amount in the mutual banks was $1,960,709,131. The growth of savings deposits is one of the best evidences of the increase in the wealth of the country and in the improvement in the condition of the masses of the people. How rapid this growth has been within the past half century may be judged from the following table:—

Conditions of Savings Banks of the United States

| Years | Number of Banks | Number of Depositors | Deposits | Average Due Each Depositor |
|---|---|---|---|---|
| 1850 | 108 | 251,354 | $ 43,431,130 | 172.78 |
| 1860 | 278 | 693,870 | 149,277,504 | 215.13 |
| 1870 | 517 | 1,630,846 | 549,874,358 | 377.17 |
| 1880 | 629 | 2,335,582 | 819,897,425 | 350.71 |
| 1890 | 921 | 4,258,893 | 1,524,844,506 | 358.03 |
| 1895 | 1,017 | 4,875,519 | 1,810,597,023 | 371.36 |
| 1899 | 987 | 5,687,818 | 2,230,366,954 | 392.13 |
| 1900 | 1,002 | 5,875,456 | 2,384,770,849 | 405.89 |

If the nearly six million depositors in 1900 were each the head of a family, the accounts would represent about thirty millions of the population. As a matter of fact, wives and children often have their

own deposits in the states where the savings banks are popular, so that perhaps not more than fifteen millions, or twenty millions, of the population are represented by the deposits in the savings banks. If all the states had well-developed savings bank systems, on the other hand, the number of accounts and the amounts of the deposits would make a much more striking showing. As the figures stand, the number of depositors has been multiplied by more than three within thirty years, by more than two within twenty years, and by about forty per cent. within the last ten years. The amounts deposited per capita have not grown materially since 1872, which shows that the banks are used chiefly by those of small means.

The savings banks of New York, with deposits amounting to more than one-third of those in the entire United States, afford an illustration of the laws that govern prudent savings bank systems. A savings bank can be established in New York only after public announcement by advertisement, and thorough examination by the superintendent of banking, in regard to the need for the bank at the place proposed, and as to the responsibility and character of the thirteen persons proposing to form the bank. If the superintendent of banking is not satisfied that the establishment of a savings bank is expedient and desirable, and that such a bank will afford benefits in the locality not afforded by existing banks, he is required to give notice to the county clerk of the county where the bank is proposed, that he refuses to issue a certificate. The board of trustees of a savings bank is not allowed to consist of less than thirteen. They elect the officers of the bank, but no trustee is allowed to have any interest in the gains or profits of the bank, nor to receive payment for his services, except such compensation for actual services as may be voted by the majority of the board. No trustee or officer is authorized to borrow any of the funds of the bank, or to use such funds except in pursuance of its legitimate business.

The savings banks are allowed to limit the amount which any one person or society may deposit, and they may refuse to receive deposits. The aggregate amount to the credit of any one individual or society is limited by law to $3,000, except in the case of deposits arising from judicial sales, or trust funds, or interest allowed to the depositor. Some banks discourage large deposits by paying a lower rate of interest on that portion of an account in excess of $500 or $1,000. The investments of savings banks are also carefully restricted by law. They are allowed to invest in the bonds of the United States; in the stocks or bonds of New York; in the stocks or bonds of any state of the United States which has not within ten years defaulted in the payment of its debts; in the stocks or bonds of any city, county, town,

or village, meeting certain tests, and issued in conformity with law; and in bonds and mortgages on unencumbered real estate worth at least twice the amount loaned. If the loan is on unimproved property, the amount shall not be more than forty per cent. of its actual value, and such loans shall be made only upon a report of a committee of trustees who shall certify, in writing, to the value of the premises.

Savings banks are permitted to deposit money temporarily in banks or trust companies, but in New York, the attorney-general is authorized to begin proceedings, upon the recommendation of the superintendent of banking, against a savings bank which keeps an undue proportion of its money permanently on deposit in this way, instead of seeking the investments required by law. The facts given show something of the safeguards thrown by the more conservative states around the savings bank system, and justify a considerable degree of confidence in the use of the banks. The laws of other states are similar to those of New York, but may require investigation by a prudent depositor in the newer states.

The wisdom of keeping money in savings banks depends in a large measure upon the length of time which the money is to be left on deposit. Savings banks have taken pains to discourage short-time deposits and the frequent withdrawal of money. While trust companies often pay interest upon deposits from the day after they are received, savings banks pursue a plan by which the money may remain for several months on deposit without drawing any interest if it is then withdrawn. At certain regular periods of the year, usually not oftener than once a quarter, and in many cases only twice a year, the directors and officers of the bank declare a dividend, which is equivalent to a payment of interest. The by-laws usually provide for the payment of interest only on such sums as have been on deposit during the entire period of time between two regular interest days. Thus, if the interest days were January 1 and July 1, the depositor who turned in his money on December 31 would draw interest for almost the entire period, but if he turned it in on January 15, he would get no interest until the following January, when he would receive it from July 1 to the close of the year. If he deposited the money on January 15 and withdrew it on December 15 it would not fall within either of the interest periods and the bank would get the use of the money for eleven months without paying any interest.

The purpose of these regulations, as stated, is to discourage short-term accounts, and to enable the bank to invest its resources in bonds and mortgages, instead of keeping a large cash reserve. The thrifty owner of money ought to carefully consider the rules of the savings bank, and the dates on which interest would accrue, before deciding

upon a deposit. If the amount involved is large, it might pay to keep it in a trust company for two or three months, until just before the beginning of an interest period at the savings bank. It would not be worth while, however, to employ the savings bank with the expectation of earning interest, if the deposit were not substantially certain to remain over the entire interest period. These warnings apply, of course, only to the earnings of interest. There may be cases where it is desirable to intrust the money for safe keeping to the savings bank, where the amounts do not justify opening an account at a commercial bank, and where there are no trust companies, even though no interest is earned.

The deposit of money for short terms in savings banks is discouraged to some extent by the rules regarding the withdrawal of deposits. It is not difficult to open an account at a savings bank in somewhat the same manner as at a commercial bank. Information is required in regard to age, names of parents, husband, and children, in order to aid the bank in paying the money to the proper parties in case of death of the depositor. Otherwise, the signing of the signature book, and the receipts of a pass book for entering deposits, are similar to the process pursued at a commercial bank. The pass books of savings banks contain columns for the entry of interest and for withdrawals. Checks are not issued by savings banks. The banks prefer that depositors shall call in person when they desire to withdraw money. It is sufficient to state orally the amount desired. The withdrawal is then entered on the pass book, and the bank is protected by a receipt which the depositor signs for the money. The money is then counted out, and the pass book, containing an entry of the withdrawal, as well as the previous deposits and dividends declared, is returned to the depositor. At large banks, the presentation of the pass book and the request for the money may be required at a different window from that where the money is actually paid out. When sending a messenger to withdraw a savings deposit, it is advisable to send a written order for the money, with specific authority to the messenger to sign for it.

Savings banks usually have printed in their pass books a by-law requiring notice of thirty to sixty days for the withdrawal of deposits. It may be prudent, if the amount to be withdrawn is large, to give notice of intended withdrawal, in order to enable the bank to have the money on hand in desired denominations, but less than thirty days is usually sufficient for such a notice. The by-law is to protect the bank against runs, in emergencies, and it is not availed of by well-conducted banks under ordinary circumstances.